Sierra 1914C

DATA TRANSMISSION TEST SET

OPERATION MANUAL

SOM-1914C

ISSUE 1

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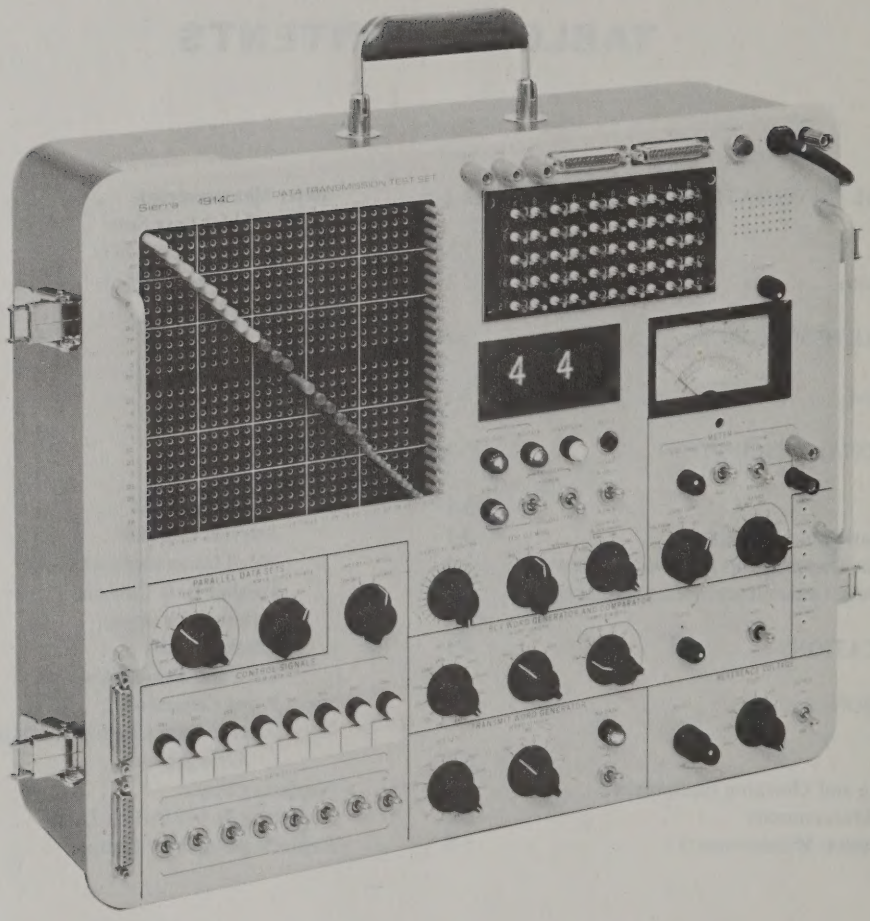

Figure 1-1. Sierra 1914C Data Transmission Test Set

SECTION 1
GENERAL INFORMATION

GENERAL

1.01 This manual contains information pertinent to the operation of Sierra 1914C Data Transmission Test Set (Figure 1-1). Included are physical and functional descriptions, operating instructions, and field-level maintenance instructions. Complete maintenance instructions, schematic diagrams, and a parts list are contained in Sierra 1914C Data Transmission Test Set Maintenance Supplement SMS-1914C. Both the operation and maintenance manuals are available to maintenance, calibration, and repair facilities by contacting Sierra Electronic Operation.

APPLICATION

1.02 The Sierra 1914C Data Transmission Test Set is a portable instrument used for static and dynamic tests of simplex, half-duplex, or full-duplex voice-band data systems and modems. It is compatible with digital and analog systems now in operation and contains built-in flexibility which will permit it to be used on future systems. The unit may be used simultaneously as a transmitting and receiving station of a data system when testing synchronous and asynchronous serial data modems, eight-channel parallel data modems, and analog modems.

1.03 A programmable, cross-point matrix connects the internal test circuits to the interface of the data modem through interface selector switches. The matrix provides total flexibility in all interface connections, permitting tests of a modem or data system while the data terminal is connected to the transmitting or receiving modem. The interface connections conform to EIA RS-232-C Recommendations and CCITT V.24 Standards. Manual generation of control signals to data sets under test are provided by signal simulation switches and monitored by lamps. An interval counting circuit measures the time interval between incoming signals and displays the interval in milliseconds on a two-decade electronic counter.

1.04 Four different test messages are generated for testing serial and certain parallel data systems – a dot signal (alternate marks and spaces), a 63-bit test word, a 511-bit test word, and a 2047-bit test word. Both automatic and manual word synchronization is provided. For tests of asynchronous data modems, test messages are generated by the 1914C clock at any of 10 bit rates in the range from 150 to 2400 bits per second. Synchronous data modems that recover their own clock signals may be tested at any bit rate in the range from 10 to 20,000 bits per second. For tests of 402-type parallel data sets, the 1914C generates the test message at a rate of 75 bits per second.

1.05 The 1914C assesses data transmission performance in terms of interval and pulse duration measurements and the bit or block error rate of the system. In tests of asynchronous modems, a means is provided for determining the error margin. A comparator samples each received bit with a 0.5-microsecond pulse at the mid-bit position. The width of the sample pulse may be adjusted in 10-percent steps, from 10 to 70 percent. A discrepancy between the received bit and the bit generated by the test set during the sampling period is registered as an error. Error counts are displayed on the electronic counter. In block error tests, the block length can be adjusted from a minimum of 63 bits to a maximum in excess of 32,000 bits. One or more errors in the block of preselected length is registered on the counter as a single count.

1.06 Eight-channel parallel data sets are tested by applying a test word or either a dot or steady space to the eight parallel data channels in the form of a contact closure. The channels may be tested individually or simultaneously. The comparator checks each bit or each parallel group of bits for errors and displays the total number of errors on the counter. Analog data sets are tested by applying a precise dc voltage to the transmit data leads and measuring the receive data output voltage. The dc voltage may be selected in steps or be continuously adjustable.

1.07 A high impedance ac voltmeter and a speaker may be used to monitor line signals. The amplifier level is adjusted by a volume control.

1.08 The 1914C test set is powered from a self-contained power supply. A source of 105- to 125-volt, 48- to 65-Hertz alternating current is required for operation.

SECTION 2
PHYSICAL DESCRIPTION

DESCRIPTION

2.01 The 1914C Data Transmission Test Set is contained in a rugged case with a carrying handle. It is designed to be operated as portable equipment. Rubber feet on two sides of the case permit the unit to be operated in a face-up position or in an upright position.

2.02 The front panel of the 1914C is shown in Figures 2-1 through 2-3. The function of all controls, switches, and indicators is given in Table 2-1. The program matrix provides access to the interface of the data set under test. The 25 vertical buses connect to the interface; the 24 horizontal buses connect to the 1914C test circuits. Connections from the input or output of the test circuits to the data set interface are made by inserting programming pins at the intersections of the appropriate vertical and horizontal buses of the matrix. The horizontal bus cross-points to RS-232-C interchange circuits and CCITT V.24 interchange circuits is given in Table 2-2, along with all pin designations for 1914C connectors A and B.

2.03 A hinged lid inside the test set cover provides a compartment for storing interface connectors and test leads. A pin storage cup located in the center of the cover is sealed shut when the lid is closed. When the test set cover is removed, the instrument may be lifted from its case for maintenance and certain operational tests by turning the four quick-release fasteners on the bottom of the case in a counterclockwise direction. The fuse panel and spare fuse board are located on the rear of the chassis (Figure 6-2).

Table 2-1. 1914C Front Panel Controls, Indicators, and Connectors

INDEX NO. FIG. 2-1	DEVICE	FUNCTION
1	Program matrix	A pin-programmable matrix for connecting test circuits to serial data and parallel data interface leads.
2	Interface selector switches	Twenty-five pairs of switches connecting the 25-pin serial data connectors A and B to the program matrix.
3	TP1 and TP2	Signal input for interval counter.
4	TP3	Reference voltage output.
5	Connector A	Provides connections to serial business machines.
6	Connector B	Provides connections to serial data sets.
7	Power switch and lamp	A 115-volt ac power OFF-ON control with an internal lamp indicator.
8	GRD connector	Provides ground or a signal return point.

Table 2-1. 1914C Front Panel Controls, Indicators, and Connectors (Cont)

INDEX NO. FIG. 2-1	DEVICE	FUNCTION
9	Speaker	Permits monitoring of audio test signal present on the meter input terminals.
10	Digital readout	A two-decade numerical readout (0 to 99) of the interval, block error, or bit error counts.
11	VOLUME control	Allows audio level adjustment of the speaker output.
12	Meter	Displays ac voltage, dc voltage, resistance, and signal level in dBm (referenced to a 600-ohm lead) of the circuit under test.
13	Meter ZERO OHMS control	Permits zero adjustment of the meter for resistance measurement.
14	Meter POLARITY switch	Allows polarity reversal of dc voltages.
15	Meter INPUT terminals	Input to meter for external measurements.
16	TERM switch	Switches a 4-dB pad across the meter input.
17	ERRORS test point	Monitoring point for error signals of the receive circuits.
18	RCV CLOCK test point	Monitoring point for clock signals of the receive circuits.
19	RCV DATA test point	Monitoring point for data signals of the receive circuits.
20	SYNC test point	Monitoring point for word synchronization signals of the receive circuits.
21	TRMT CLOCK test point	Monitoring point for clock signals of the transmit circuit.
22	TRMT DATA test point	Monitoring point for data signals of the transmit circuits.
23	CONTROL SIGNALS switches (S1-S8)	Apply voltage or contact control signals to horizontal buses on the program matrix.
24	Marking strip	Provides a writing surface for the temporary labeling of the control circuits.
25	CONTROL SIGNALS lamps (DS1-DS8)	When illuminated, indicate the presence of control signals (+4 volts or contract closure) on the designated horizontal bus of the program matrix.
26	Parallel data TEST MODE switch	Selects a dot, space, or psuedorandom word to all eight channels, or a pseudorandom word to one of eight channels.
27	Parallel data TRMTR CLOCK PHASE switch	Selects a normal, retard (1.5 ms), or advance (1.5 ms) phase of the transmitter clock.

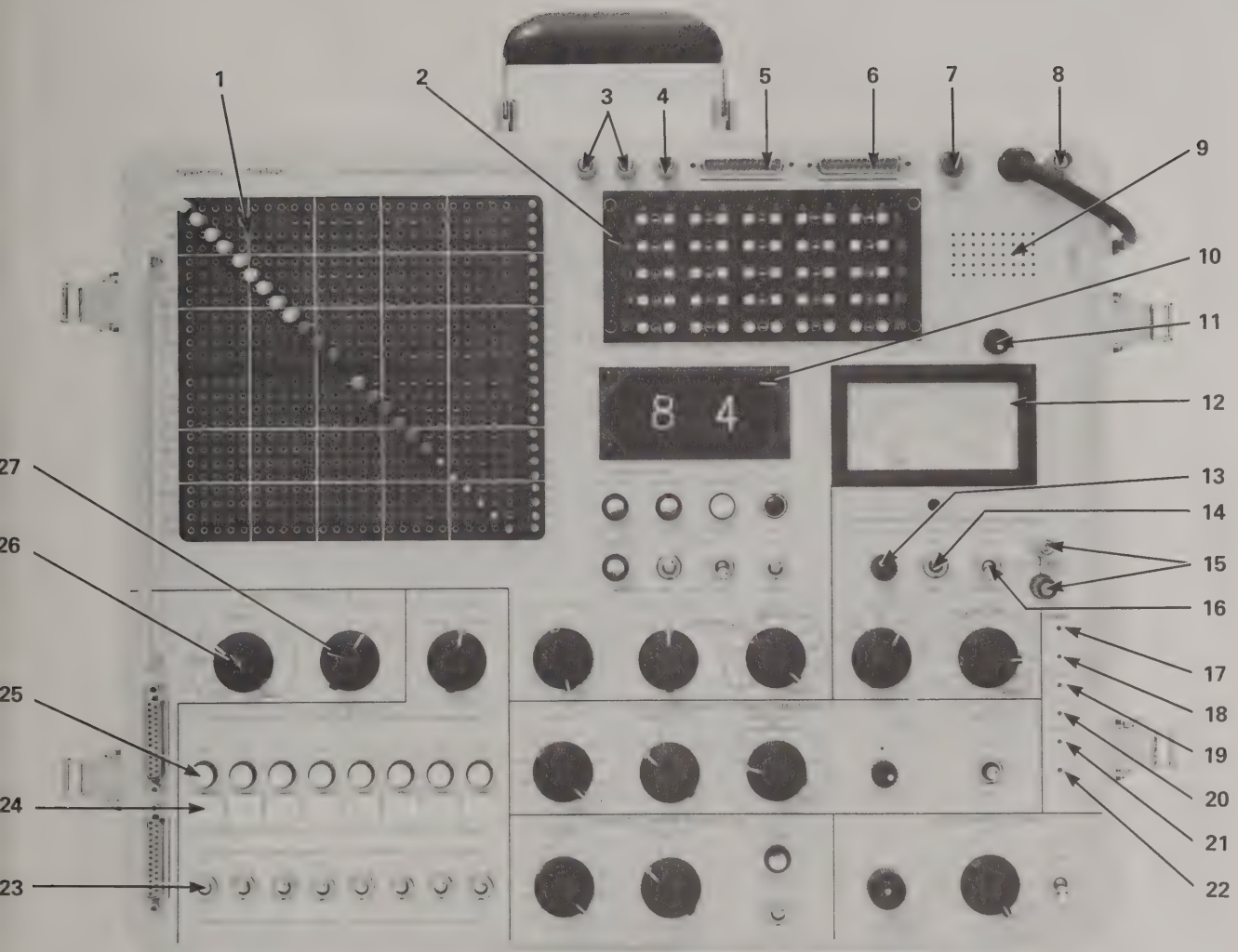

Figure 2-1. Sierra 1914C Data Transmission Test Set, Front Panel (1)

Table 2-1. 1914C Front Panel Controls, Indicators, and Connectors (Cont)

INDEX NO. FIG. 2-2	DEVICE	FUNCTION
28	VERTICAL MONITOR switch	Selects one of the 25 vertical buses of the program matrix as an input to the meter.
29	TEST SET MODE switch	Selects the 402 (parallel) data set mode, the serial data set mode, or the interval counting mode of testing.
30	COUNTER switch	Selects a counting interval signal, a block error signal, or a bit error signal as the input to the decade counter and display.
31	Reference voltage OUTPUT switch	Provides ON/OFF control of the selected reference voltage on TP3.
32	Reference voltage SELECT switch	Selects a fixed or adjustable reference voltage to be applied to TP3.
33	Reference voltage ADJUST control	Provices coarse and fine adjustment of the selected adjustable reference voltage applied to TP3.
34	Transmit NO DATA lamp	When illuminated, indicates the loss of transmitted data.
35	Transmit SIG LEV switch	Selects a ±4.0-volt or a ±0.7-volt test pattern output level.
36	Receive clock SAMPLE WIDTH switch	Selects a 0.5-microsecond clock or clocks having pulse widths equal to 10, 20, 30, 40, 50, 60, or 70 percent of the data bit period.
37	Transmit WORD LENGTH switch	Selects a dot or 63-bit, 511-bit, or 2047-bit word test pattern for the transmit word generator.
38	Receive WORD LENGTH switch	Selects a dot or 63-bit, 511-bit, or 2047-bit word test pattern for the receive word generator.
39	Transmit BIT RATE switch	Selects one of ten transmit timing signals internally generated for use with asynchronous data sets, and selects true or inverted timing signals for use with synchronous data sets.
40	Receive BIT RATE switch	Selects one of ten receive timing signals internally generated for use with asynchronous data sets, and selects true or inverted timing signals for use with synchronous data sets.

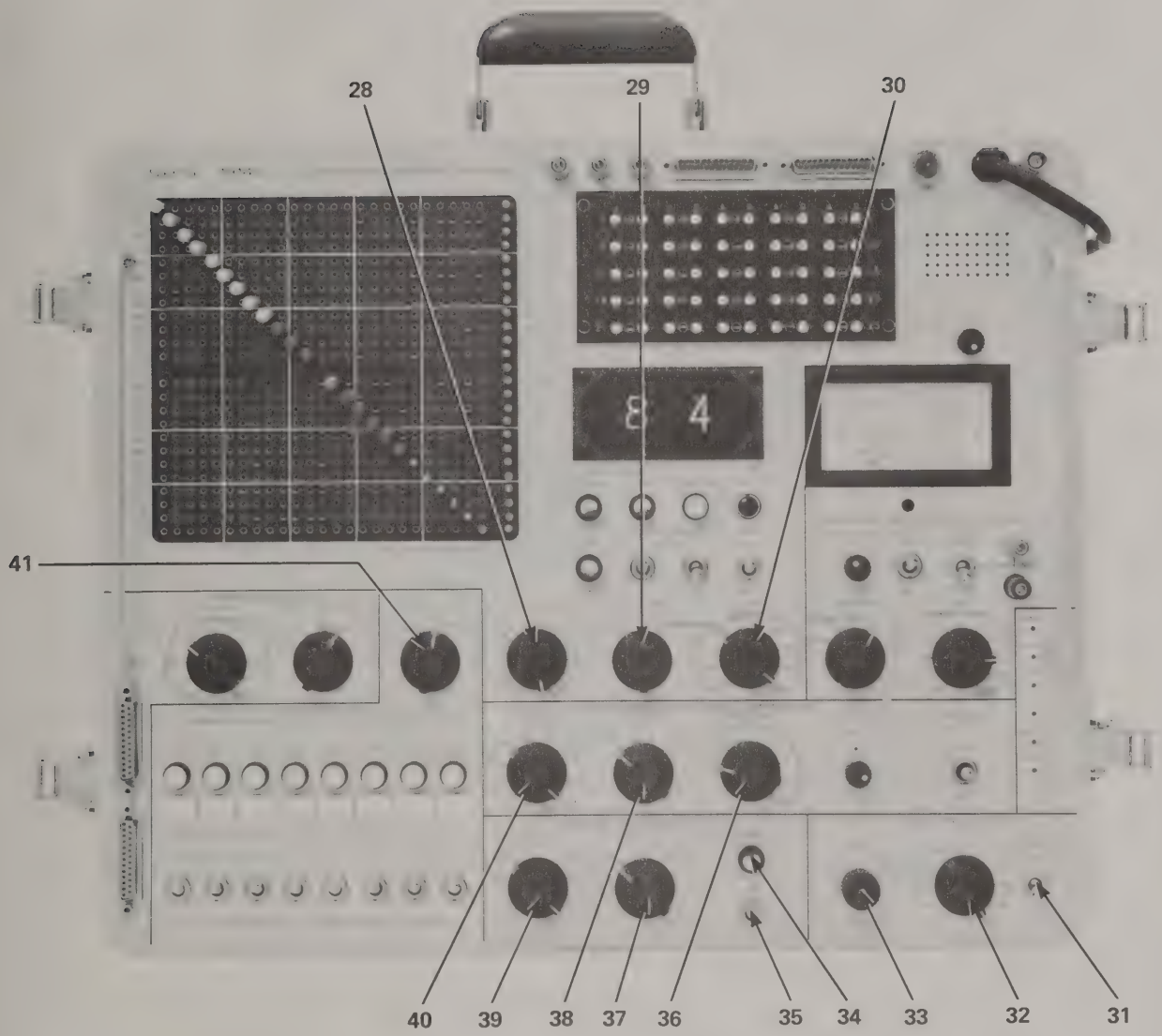

Figure 2-2. Sierra 1914C Data Transmission Test Set, Front Panel (2)

Table 2-1. 1914C Front Panel Controls, Indicators, and Connectors (Cont)

INDEX NO. FIG. 2-3	DEVICE	FUNCTION
41	INTERFACE MODE switch	Selects the voltage or the contact mode for the data set control signals.
42	Receive NO CLOCK lamp	When illuminated, indicates the loss of the received clock.
43	Receive NO DATA lamp	When illuminated, indicates the loss of the received data.
44	OVERFLOW lamp	When illuminated, indicates that the digital readout has exceeded 99 counts.
45	RESET pushbutton switch	Resets the decade counter and display.
46	FUNCTION switch	Selects speaker, external voltage or resistance, internal voltage, VCO phase adjust, or off inputs to the speaker or the meter.
47	Meter RANGE switch	Selects the ac or dc voltage range or the resistance rnage of signal inputs to the meter.
48	Receive clock PHASE control	Allows frequency adjustment of the VCO for clock synchronization.
49 swi	Receive WORD SYNC switch	Selects manual, automatic, or off mode for the receive word generator.
50	START switch	Selects the signal on TP1 (A ONLY) or the signal on TP1 or TP2 (A OR B) that will start the count interval.
51	TP1 TRIGGER and TP2 TRIGGER switches	Select the open (+) or closed (–) transition of signals on TP1 and TP2 inputs that will start the count interval.
52	TP1 FIRST lamp	When illuminated, indicates that the count interval test was started by the signal on TP1.
53	Connector D	Provides connections to parallel receiving data sets.
54	Connector C	Provides connections to parallel transmitting data set.

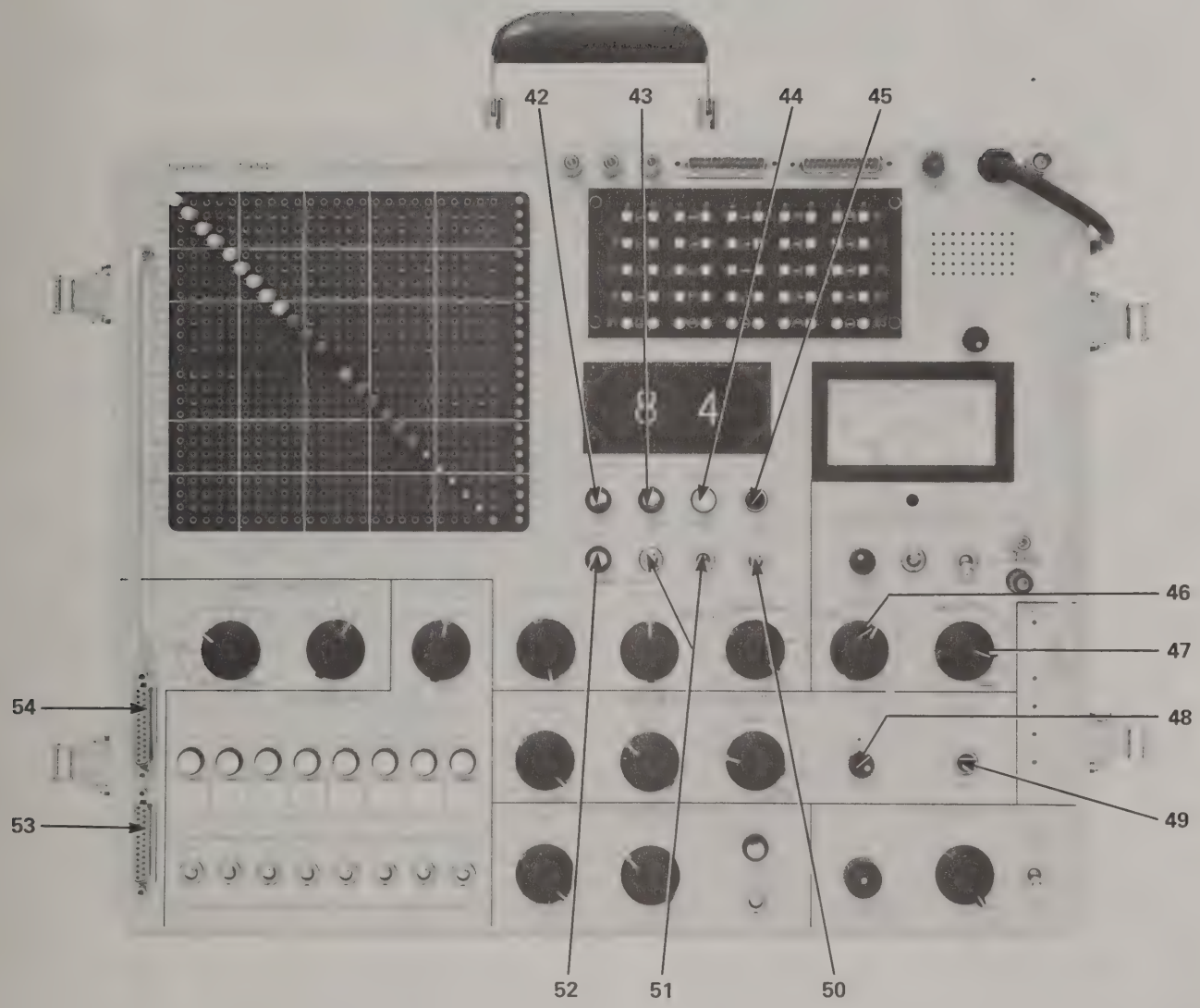

Figure 2-3. Sierra 1914C Data Transmission Test Set, Front Panel (3)

Table 2-2. EIA and CCITT Connector Pin Assignments and 1914C Matrix Cross-Point Connections

NOTE: For the convenience of users whose equipment conforms to EIA-RS-232-B Requirements, where the pin assignment differs from the RS-232-C assignment the RS-232-B designation is given in parenthesis.

RS-232-C INTER-CHANGE CIRCUIT	CCITT V.24 INTER-CHANGE CIRCUIT	1914C HORIZONTAL CROSS-POINT BUS	CONNECTORS A AND B PIN NO. AND VERTICAL BUS POSITION NO.	RS-232-C PIN ASSIGNMENT
AA	101	GRD	1	Protective Ground
BA	103	SD	2	Transmitted Data
BB	104	RD	3	Received Data
CA	105	--	4	Request to Send
CB	106	--	5	Clear to Send
CC	107	--	6	Data Set Ready
AB	102	AB	7	Signal Ground/Common Return
CF	109	--	8	Received Line Signal Detector (Data Carrier Detector)
--	--	--	9	Reserved for Data Set Testing
--	--	--	10	Reserved for Data Set Testing
--	--	--	11	Reserved for Data Set Testing
SCF	122	--	12	Secondary Received Line Signal Detector (Unassigned)
SCB	121	--	13	Secondary Clear to Send (Unassigned)
SBA	118	--	14	Secondary Transmitted Data (Unassigned)
DB	114	SCT	15	Transmission Signal Element Timing – DCE Source
SBB	119	--	16	Secondary Received Data (Unassigned)
DD	115	SCR	17	Received Signal Element Timing – DCE Source
--	--	--	18	Unassigned
SCA	120	--	19	Secondary Request to Send (Unassigned)
CD	108	--	20	Data Terminal Ready
CG	110	--	21	Signal Quality Detector (Unassigned)
CE	125	--	22	Ring Indicator
CH/CI	111/112	--	23	Data Signal Rate Selector – DTE/DCE Source (Unassigned)
DA	113	--	24	Transmit Signal Element Timing – DTE Source
--	--	--	25	Unassigned

SECTION 3
FUNCTIONAL DESCRIPTION

GENERAL

3.01 This Section presents the functional description of the 1914C Data Transmission Test Set. The discussion covers the overall function of the equipment, serial data transmit and receive functions, and parallel data transmit and receive functions.

OVERALL FUNCTION OF TEST SET

3.02 The functional block diagram of the 1914C Data Transmission Test Set is shown in Figure 3-1. Data sets to be tested are connected to the 1914C through connectors A and B (or C and D for 402-type or other parallel-type data sets). The interface selector switch assembly consists of 25-separate switches that connect the 25-pin serial data interface connectors to the vertical buses of the program matrix. The interface selector switches are shown schematically in Figure 3-2. Each A and B section is a combination of two switches and a test point. This feature makes all interface signals accessible for external connections and permits testing modems with the terminal equipment connected to the test set. With both sections of the switch closed, the corresponding pins on connectors A and B are interconnected and connected to corresponding vertical bus numbers on the matrix. When either switch section A or B is open, the corresponding pin on the connector is disconnected from the matrix bus to which it was connected.

3.03 Figure 3-3 shows one arrangement for in-service testing. A business machine is connected to connector A and a data set to connector B. By closing both the A and B sections of an interface selector switch, the signal on that particular lead becomes available on a vertical bus of the program matrix in a bridging connection. Any lead between the business machine and the data set can be opened for testing signals at either the business machine or data set by opening or closing the A or B section of the appropriate selector switch.

3.04 The program matrix provides the means of connecting serial data and parallel data interface leads to the 1914C test circuits. It consists of 24 horizontal and 25 vertical buses. The vertical buses are connected to the A and B (or C and D) data interface connectors. The horizontal buses are connected to the 1914C test circuits. Each of the interface leads are shunted by a 300-kilohm resistor to provide marginal open-circuit loading for the contact interface. Connection between the horizontal buses on the matrix board are made by programming pins inserted into the matrix. These may be shorting pins, or pins with a built-in resistance of 10 ohms, 18 ohms, or 10 kilohms. The 10-ohm pin is used to simulate contact resistance in tests of 402-type data sets. The 10-kilohm pin increases the impedance of lamp drivers when the test set is bridged between a data set and a business machine.

3.05 Manual generation of control signals to the data sets under test and monitoring of control signals from the data sets are provided by eight signal simulation and monitoring circuits. The signal simulator switches, S1 through S8, are connected to horizontal buses on the program matrix board. In the CONTACT mode and with the corresponding switch operated, a contact closure to ground will illuminate the lamp. With the signal simulator switch in its off position, an open circuit will extinguish the lamp. In the VOLTAGE mode and with the corresponding switch operated, a +4-volt signal will illuminate the lamp, and –4 volts with the switch in the off position will extinguish the lamp.

3.06 The interval counting circuit measures the time interval between a signal on the TP1 bus and another signal on the TP2 bus (or on test jacks TP1 and TP2) and drives the digital display to indicate the interval in milliseconds or multiples thereof. The signal can be a positive or negative transition or a contact opening or closing, depending on the position of the TRIGGER switches. The signals can be applied to the counting

circuit from the program matrix or from the TP1 and TP2 test jacks. The interval counting circuit also determines which signal arrives first and indicates this information whether or not the TP1 FIRST lamp is illuminated. The START switch may be set to the A ONLY position, forcing a signal on TP1 to be first.

3.07 The meter circuits measure dc voltage, ac voltage, resistance, and signal levels in dBm (600-ohm line calibration). A speaker is provided for monitoring audio signals. Ac voltages and resistances can be measured only with the circuit to be measured connected to the meter INPUT terminals. Dc voltages to be measured can be connected to the INPUT terminals, or the VERTICAL MONITOR switch can be used to select a vertical matrix bus whose dc voltage is to be measured. The amplifier for the meter/speaker circuit receives its input from the meter INPUT terminals or the VERTICAL MONITOR switch that selects one of the vertical buses of the matrix. When an audio signal on a line connected to the INPUT terminals is to be monitored, turning the FUNCTION switch to the SPKR position and the RANGE switch to an ACV position will connect the speaker. The VOLUME control adjusts the speaker output level.

3.08 The reference voltage circuit provides fixed or adjustable voltages to test point TP3 on the front panel and to horizontal bus TP3 on the program matrix when the OUTPUT switch is in the TP3 position. The REFERENCE VOLTAGE switch selects fixed voltages of 0, ±0.477, ±1.0, ±2.0, and +7 volts. In addition, positive and negative voltages are adjustable from 0 to 10 volts. An ADJUST voltage control provides coarse and fine adjustment of the selected adjustable reference voltage applied to TP3.

3.09 The 1914C power supply provides two unregulated outputs of +23 and +200 volts and three regulated outputs of +12, -12, and +5 volts for operation of the test set circuits. Input to the power supply is 105 to 125 vac at 48 to 65 Hz.

SERIAL DATA TRANSMIT AND RECEIVE SECTIONS

3.10 A functional block diagram of the serial data transmit and receive sections of the 1914C is shown in Figure 3-4. Serial data transmit test functions receive a transmit clock (STC) from and transmit serial data (SD) to serial data sets. The transmit and receive clocks are entirely independent, permitting the 1914C to run in full-duplex mode. The transmit clock rate is selected by the transmit BIT RATE switch. The receive section derives its nominal clock rate from the receive BIT RATE switch. In testing asynchronous signals, the receive clock circuits recover the bit timing signal from the incoming data stream. The PHASE control permits precise synchronization with the incoming data signals. When the transmit and receive BIT RATE switches are in either of the EXT positions, the 1914C receives its timing signal from the SCT and SCR lines of the matrix.

3.11 The clock signal, either internal or external, is applied to the word generator. The word generator generates a dot signal (alternate marks and spaces), a 63-bit test word, a 511-bit test word, or a 2047-bit test word, depending on the setting of the WORD LENGTH switch. Both the transmit and receive sections are identical in this respect.

3.12 The data transmit section generates and transmits test patterns from one of ten internally generated timing signals or from an externally generated timing signal. The ten internally generated timing signals, ranging from 150 to 2400 bits per second, are used with asynchronous data sets. The externally generated timing signal, ranging from 10 to 20,000 bits per second and used with synchronous data sets, is received from the horizontal program matrix bus labeled SCT when the TEST SET MODE switch is in the SER position.

3.13 The data receive section generates a test pattern identical to that of the transmit section. It compares the received data with the generated test pattern, generates bit or block errors, and transfers the error signals to the counting circuits. As in the transmit section, ten timing signals ranging from 150 to 2400 bits per second are internally generated for use with asynchronous data sets, and a timing signal with a range of 10 to 20,000 bits per second is externally generated for use with synchronous data sets. The external signal is received from the horizontal bus labeled SCR when the TEST SET MODE switch is in the SER position.

3.14 Errors in the received data signal are detected by comparing it with a test signal that is identical to the transmitted test signal. The comparison requires that the received and the locally generated test signals be synchronized, namely, that the corresponding bits of the two test signals be aligned. Word synchronization is accomplished either manually or automatically, depending on the setting of the WORD SYNC switch.

3.15 When the WORD SYNC switch is momentarily depressed to the MAN position, the receive test signal generator is forced into synchronism with the received test signal within a fraction of a second. When the WORD

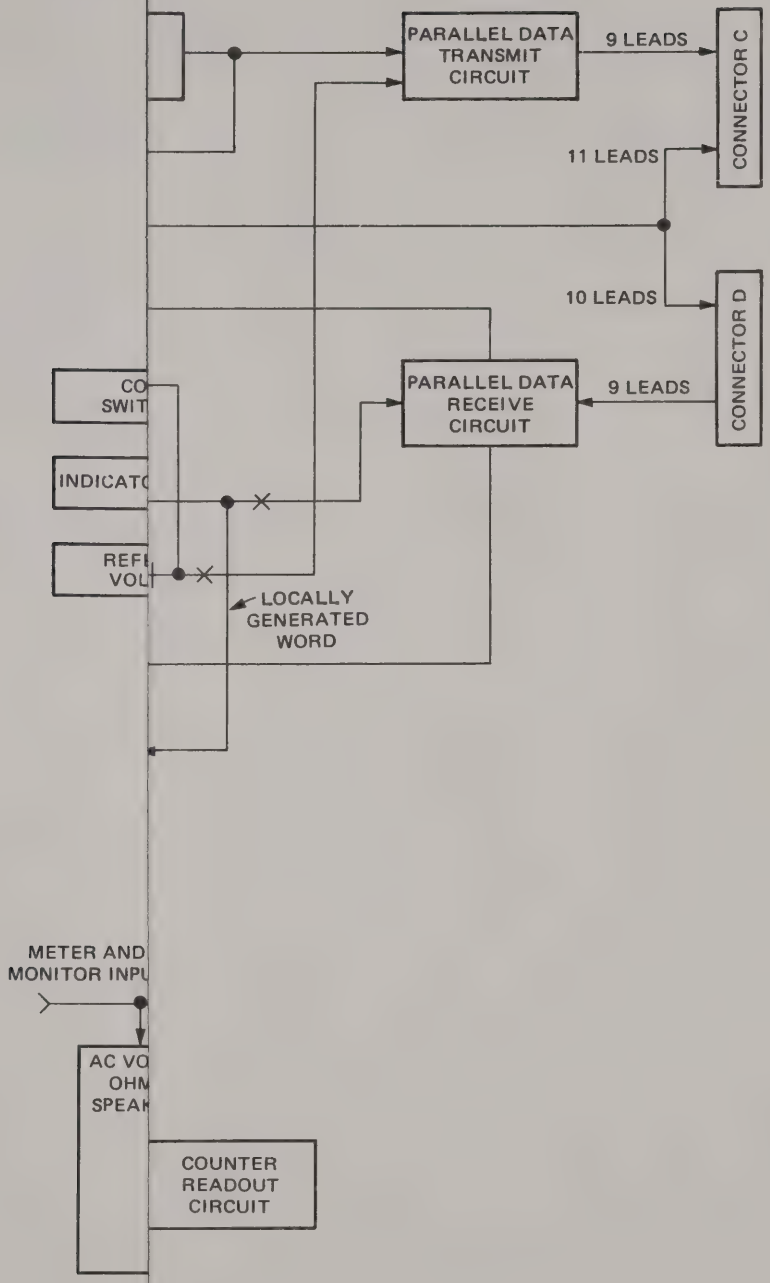

Figure 3-1. Sierra 1914C Data Transmission Test Set, Functional Block Diagram

circuit from the program matrix or from the TP1 and TP2 test jacks. The interval counting circuit also determines which signal arrives first and indicates this information whether or not the TP1 FIRST lamp is illuminated. The START switch may be set to the A ONLY position, forcing a signal on TP1 to be first.

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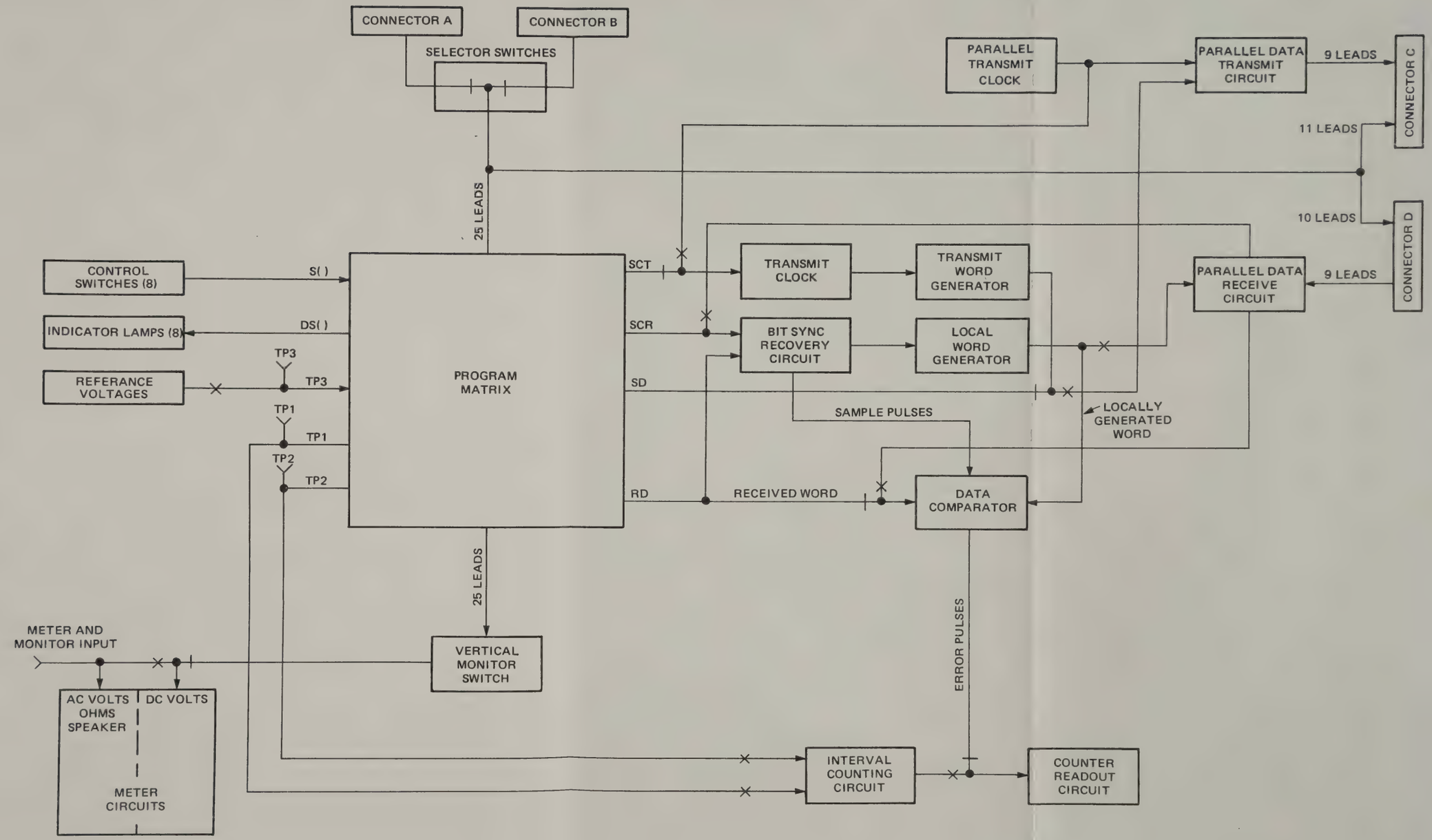


Figure 3-1. Sierra 1914C Data Transmission Test Set, Functional Block Diagram

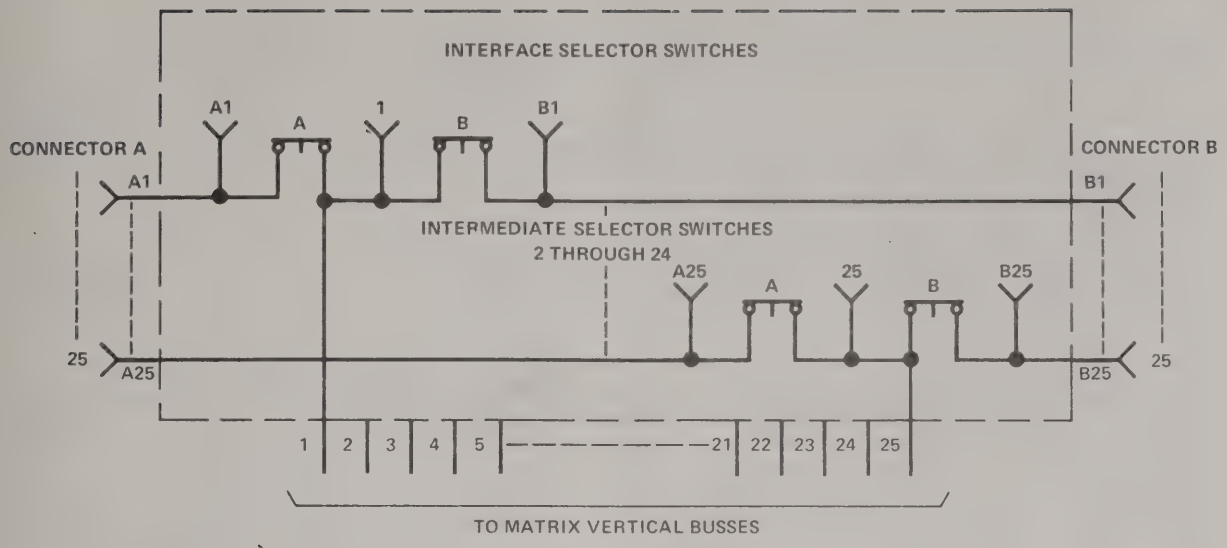


Figure 3-2. Interface Selector Switches, Schematic Diagram

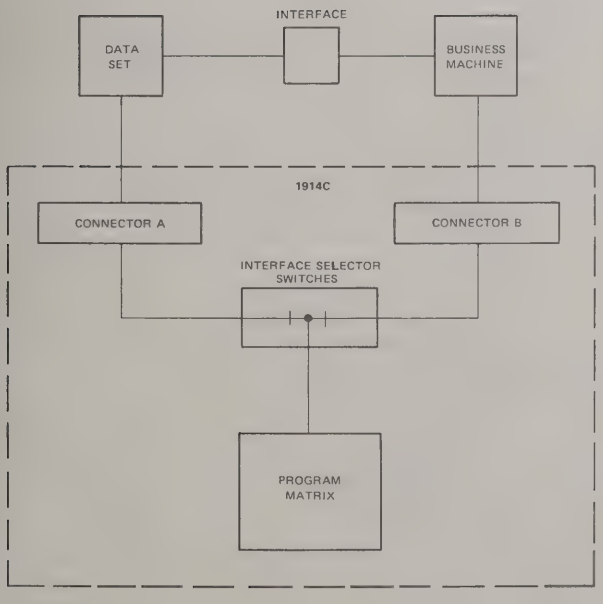


Figure 3-3. Arrangement for In-service Testing

SYNC switch is operated to the AUTO position, the receive test signal generator is constantly resynchronized with the received test signal. Because of the method of synchronization, the error count recorded in the AUTO mode is approximately three times the true error count.

3.16 The received data signal is compared with the locally generated test signal during a brief sampling interval coincident with the center of each received bit. In tests of asynchronous data sets, the sampling interval can be lengthened to include greater portions of the bit. Any discrepancy between the received bit and the locally generated bit during the sampling interval is registered as an error. The SAMPLE WORD switch selects the width of the sample interval, starting at 0.5 microsecond and continuing in steps of 10 percent of the bit interval up to a maximum of 70 percent. This variable-width sampling technique allows checking the error margin of the received signal.

3.17 With the COUNTER switch set to the BIT ERRORS position, individual bits in error are counted. When the COUNTER switch set to one of the BLOCK ERRORS positions, the number of blocks of selected length that contain one or more errors is counted. The block length is selected as the indicated multiple (WL, 2WL, 4WL, etc) of the word length (63, 511, or 2047). The minimum block length is 63 bits, the maximum is in excess of 32,000 (16 x 2047) bits.

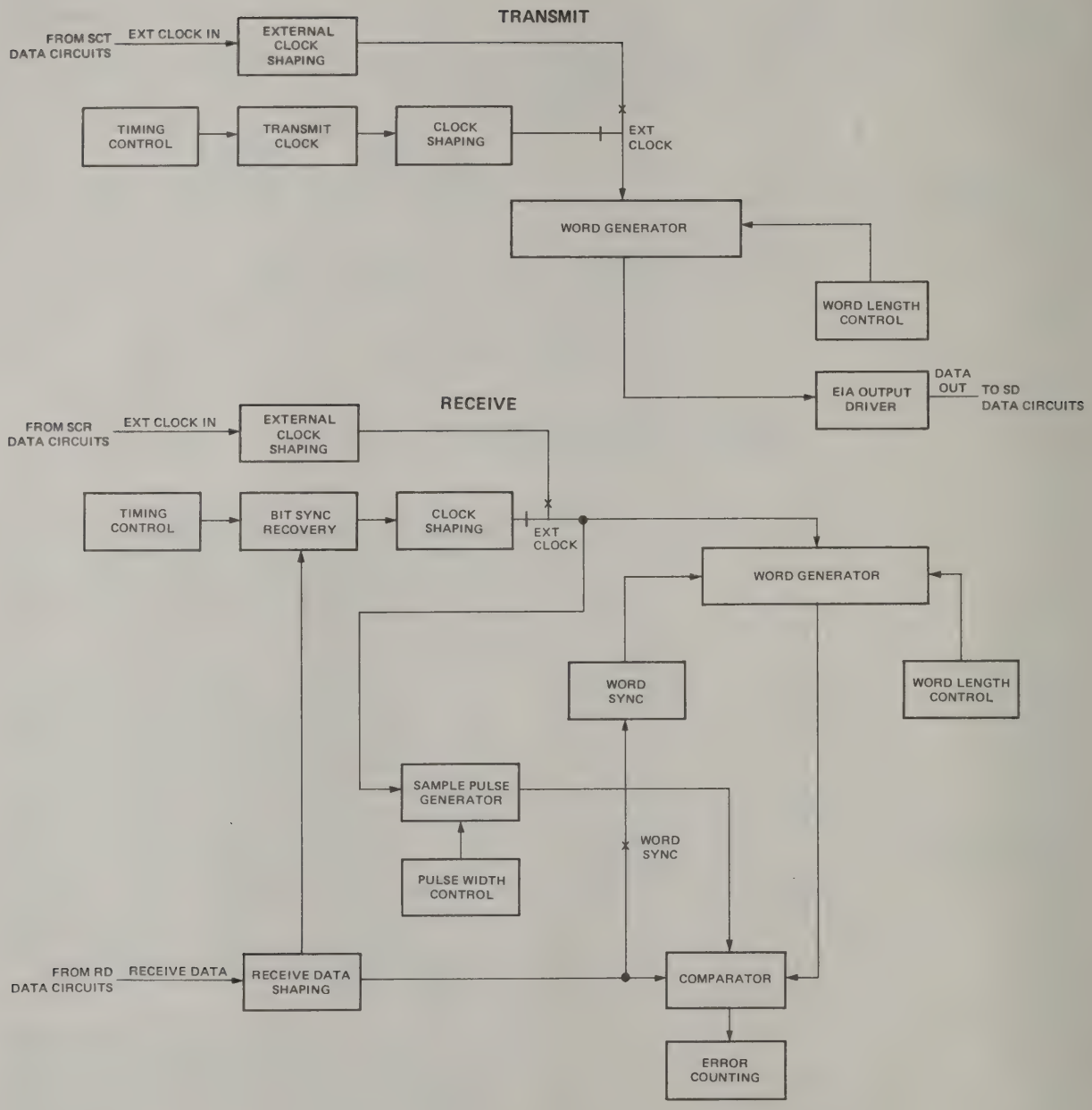


Figure 3-4. Serial Data Transmit and Receive Circuits, Functional Block Diagram

3.18 A SIG LEV switch selects output signal levels of ±4.0 volts or ±0.7 volt. A NO DATA lamp illuminates when test data is not being generated by the test pattern generator. Two test points (TRMT CLOCK and TRMT DATA) are provided to monitor the selected clock and data test pattern signals.

PARALLEL DATA TRANSMIT AND RECEIVE FUNCTIONS

3.19 A functional block diagram of the parallel data data transmit and receive sections of the 1914C is shown in Figure 3-5. Selected by the 402 position of the TEST SET MODE switch, the parallel data transmit section transmits on eight-bit parallel data test pattern to parallel data circuits. It operates from an internally generated bit rate of 75 bits per second, or from one of the ten internally generated bit rates (150 to 2400 bits per second) under control of the TRANSMIT BIT RATE switch.

3.20 The signal applied by the internal clock is applied to two dot generating circuits. One dot generator provides a fixed timing signal to the timing channel of the data set. It also provides a simulated advance or delay in phase with respect to the data signal when required. The output of the other dot generator is applied to one or all of the parallel data channels along with the test word and selected bit rate.

3.21 The output interface from the timing channel and data channel output drivers provides a contact closure interface for eight-channel parallel data sets. The transmit timing and test pattern signals are connected by connector C on the front panel. The receive parallel data set channels are connected to connector D.

3.22 The parallel data receive section receives a timing signal from the data set timing channel and an eight-bit parallel test pattern. As in the transmit section, this test mode is selected by the 402 position of the TEST SET MODE switch. The parallel data receive channels may be tested individually or simultaneously. When tested on an individual basis, the received data signal is compared with the test set signal during a sampling interval, where any discrepancy between the received bit and the locally generated bit is registered as an error. When all channels are checked simultaneously, the inputs from all channels are combined and compared to the word generated locally. If one or more channels are in error, the error signal is fed to the data comparator and registers as an error on the electronic counter.

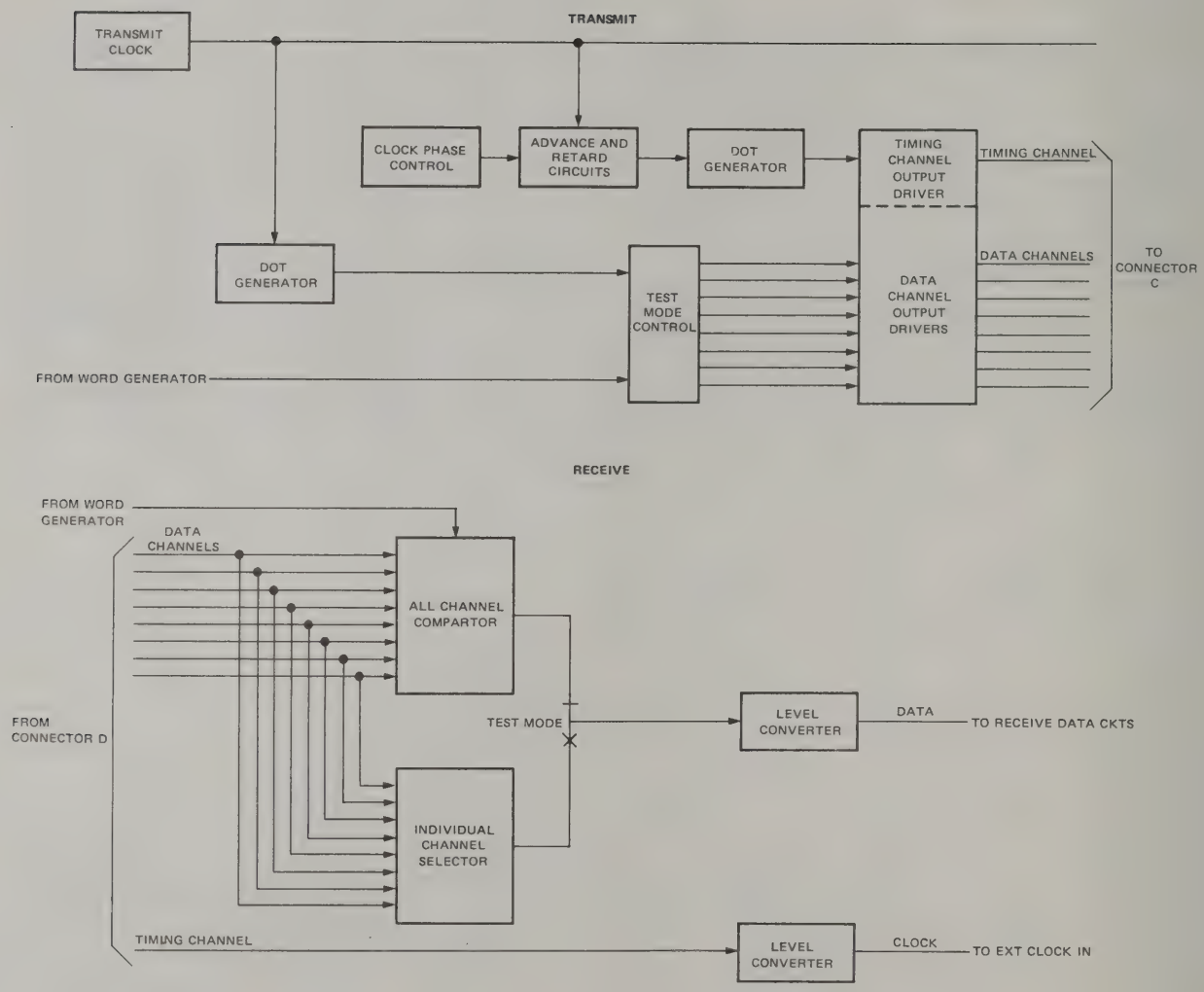


Figure 3-5. Parallel Data Transmit and Receive Circuits, Functional Block Diagram

SECTION 4
SPECIFICATIONS

4.01 The specifications for the Sierra 1914C Data Transmission Test Set are listed in Table 4-1. The table presents the characteristics of the test set in three separate categories: serial data circuits, eight-channel (402 type) parallel data circuits, and control circuits. Signal outputs and inputs are available at the program matrix and the various test points on the front panel (Figures 2-1 through 2-3).

Table 4-1. Specifications for Sierra 1914C Data Transmission Test Set

PARAMETER	CHARACTERISTIC
Serial Data Circuits	
Receive Data (RD) and Send Data (SD) Format	Nonreturn to zero (NRZ)
Impedance:	
Input	3000 ohms minimum 7000 ohms maximum
Output	200 ohms
Load Impedance:	
Resistive	3000 to 7000 ohms
Capacitive	2500 picofarads
Amplitude:	
Input	±3 volts minimum ±25 volts maximum
Output	Mark: −4.0 volts ±0.3 volt high level −0.7 volt ±0.15 volt low level Space: +4.0 volts ±0.3 volt high level +0.7 volt ±0.15 volt low level
Rise and Fall Time (SD)	$<$1 microsecond
Jitter (asynchronous RD signals)	40 percent maximum peak-to-peak
Bit Rates:	
Asynchronous	Ten bit rates from 150 to 2400 bits per second
Synchronous	10 to 20,000 bits per second

Table 4–1. Specifications for Sierra 1914C Data Transmission Test Set (Cont)

PARAMETER	CHARACTERISTIC
Serial Data Circuits (Cont)	
Interface	Conforms to EIA RS–232–C Standards and CCITT V.24 Recommendations (see Table 2–2)
Clock Signals:	
Receive Clock Signal (SCR) and Transmit Clock Signal (SCT) format	Squarewave
Frequency	10 to 20,000 Hz
Phasing:	
Receive Clock Signal (SCR)	Off-to-on transitions normally occur at the time of the receive data transitions
Transmit Clock Signal (SCT)	Off-to-on transitions normally occur at the time of the send data transitions
Eight–Channel Parallel Data Circuits	
Input and output format	Nonreturn to zero (NRZ)
Bit rate	75 bits–per–second
Signal	Contact closure to ground – Mark: Closed contact Space: Open contact
Transitions:	
Input	Occur prior to the transitions of the timing signal
Output	Must occur within ±1.5 millisecond of the change of state
Chatter (SD)	Less than 0.5 millisecond
Interface:	
Input	100 milliamperes maximum load (500 milliamperes surge) at up to 50 volts during a contact closure
Output	Closed contact: <20 ohms Open contact: >300K ohms resistance and 300 ±100 picofarads capacitance to ground

Table 4-1. Specifications for Sierra 1914C Data Transmission Test Set (Cont)

PARAMETER	CHARACTERISTIC
Eight-Channel Parallel Data Circuits (Cont)	
Timing Signals:	
Format	Squarewaves
Transitions	Input: A 5-millisecond closure at beginning of each character Output: Must occur at beginning of each character and contact must remain constant for the duration of the character
Control Signal Inputs (DS1-DS8)	
Voltage Level Mode:	
Level	Off: 0 to -4 volts dc On: +3 to +4.0 volts dc
Impedance	3000 ohms series resistance
Contact Closure Mode	Off: Open circuit On: Closed circuit to ground
Control Signal Outputs (S1-S8)	
Voltage Level Mode	Off: -3.5 to -5.0 volts dc On: +3.5 to +5.0 volts dc
Impedance	300 ohms resistive (series)
Contact Closure Mode	Off: Open circuit On: Closed circuit to ground
Reference Voltage (TP3) Output	
Levels	0 to ±9.5 volts dc
Load	Voltage Level (volts) / Minimum Resistance to Ground (ohms) +7 / No load ±2, ±1 / 51K ± 0.477 / 5.1K

Table 4-1. Specifications for Sierra 1914C Data Transmission Test Set (Cont)

PARAMETER	CHARACTERISTIC
General	
Power Requirements	
Amplitude	115 volts ac
Frequency	48 to 65 Hz
Power	60 watts, approximately
Environmental Considerations	
Operating Temperature Range	+5°C to +50°C
Humidity	95 percent maximum
Dimensions	
Height	15 inches (381 mm)
Width	18-1/2 inches (470 mm)
Depth	7-1/2 inches (191 mm)
Weight	Approximately 27 pounds (12.3 kg)

SECTION 5
OPERATION

GENERAL

5.01 This section contains unpacking and checking information and detailed instructions for operating the 1914C Data Transmission Test Set.

UNPACKING AND CHECKING EQUIPMENT

5.02 Carefully unpack the test set and inspect it for damage. Do not dispose of the shipping carton or cushioning material until the instrument has been checked mechanically and electrically. Check the equipment received against the shipping list. If there is any evidence of damage, if any part of the order is missing, or if the test set does not operate properly, contact the Customer Service Department at the following address:

Customer Service Department
Sierra Electronic Operation
Philco-Ford Corporation
3885 Bohannon Drive
Menlo Park, California 94025
Phone: (415) 322-7222
TWX: 910-373-1282

NOTE: Do not repack damaged or faulty equipment for return to Sierra Electronic Operation under the provisions of the Warranty without first contacting Sierra for specific instructions.

5.03 Perform the equipment operational test (Paragraph 6.02) upon receipt of the test set, after extended periods of storage, and if the test set is not operating properly.

INTERVAL MEASUREMENTS

5.04 The interval counter is used to check the sequence in which control leads are actuated, and to time the interval between signals. Depending on the positions of the TRIGGER switches, the signal may be a positive or negative transition or a contact closure. The lead that controls the start of the counter is selected by the position of the START switch, with A corresponding to TP1 and B to TP2. If the signal occurs first on TP1, the TP1 FIRST lamp will light. If the signal occurs first on TP2, the TP1 FIRST indicator lamp will not light. The time interval between pulses on the two leads are displayed on the electronic counter. To measure the time interval between pulses on the TP1 and TP2 leads, proceed as follows:

Step 1
Apply the signals to be measured directly to the TP1 and TP2 terminals, or to the TP1 and TP2 horizontal matrix buses with shorting pins.

Step 2
Set the TP1 TRIGGER switch to coincide with the expected TP1 signal (positive or negative), and set the TP2 TRIGGER switch in accordance with the anticipated signal on TP2.

Step 3
Set the START switch to the desired position, In the A ONLY position, the interval counter will wait for a signal on TP1 to start counting.

Step 4
Set the COUNTER switch to the appropriate range for the interval to be counted.

Step 5
Set the RCV BIT RATE switch to any internal bit rate.

Step 6
Turn the TEST SET MODE switch to INTERVAL.

Step 7
Press the RESET switch momentarily to clear the counter.

Step 8
When the measurement takes place, the number in the counter display multiplied by the factor selected by the COUNTER switch will be the measured interval in milliseconds.

Step 9
If the TP1 FIRST lamp lights, the signal on TP1 occurred before the signal on TP2. If the TP1 FIRST lamp does not light, the signal on TP2 occurred before the signal on TP1.

PULSE DURATION MEASUREMENTS

5.05 The interval counter circuit may also be used to estimate the duration of a periodic signal. Apply the signal to both the TP1 and TP2 leads and proceed as follows:

Step 1
Operate the COUNTER switch to the desired INTERVAL setting. A setting on a lower frequency such as X.10 is recommended to keep the counter from overflowing.

Step 2
Set the RCV BIT RATE switch to any internal bit rate.

Step 3
Turn the TEST SET MODE switch to INTERVAL.

Step 4
Operate the TP1 and TP2 TRIGGER switches to the same position (+/OPEN or -/CLOSE) to measure one full period or to opposite positions (+/OPEN and -/CLOSE) to measure pulse width.

Step 5
Set the START switch to A ONLY.

Step 6
Depress the RESET switch to clear the counter.

Step 7
The electronic counter displays the time interval of the period or half period selected. The number in the counter display multiplied by the factor selected by the COUNTER switch is the measured interval in milliseconds.

METER MEASUREMENTS

5.06 The front panel meter can be used to measure: (a) dc voltages on the interface leads, and (b) ac voltages, dc voltages, or resistance to ground of an external circuit.

NOTE: One side of the ohmmeter is permanently grounded to the 1914C.

5.07 **DC Voltages on Interface Leads.** To measure dc voltages on interface leads, proceed as follows:

Step 1
Turn the FUNCTION switch to VOLT INT.

Step 2
Turn the RANGE switch to the appropriate dc range.

Step 3
Turn the VERTICAL MONITOR switch to the desired interface lead number.

Step 4
Operate the POLARITY switch to NOR. The meter reading will be up-scale for positive inputs.

5.08 **AC Voltage, DC Voltage, or Resistance to Ground in External Circuit.** To measure an ac voltage, a dc voltage, or resistance to ground in an external circuit, proceed as follows:

Step 1
Connect the circuit to the INPUT terminals.

Step 2
Turn the FUNCTION switch to VOLT/OHM EXT.

Step 3
Turn the RANGE switch to the appropriate voltage or resistance range. The ac meter input is either a balanced high-impedance circuit or a 600-ohm circuit, depending on the position of the TERM switch.

CAUTION: Do **NOT** turn the RANGE switch to any of its DCV positions or to the X1Ω or X100Ω position when the FUNCTION switch is in the EXT position. The meter may be damaged. Turn the FUNCTION switch OFF when the set is to be transported.

5.09 **Speaker.** The ability to listen to signals on a line can be useful in identifying system malfunction. Noise, clicks, and crosstalk, for example, frequently cause data transmission problems. To monitor the audio signal on a line, proceed as follows:

Step 1
Connect the line to the INPUT terminals.

Step 2
Operate the RANGE switch to one of its ACV positions.

Step 3
Operate the FUNCTION switch to the SPKR position.

Step 4
Adjust the VOLUME control to the desired signal level.

TESTING SERIAL DATA SETS

5.10 Data System End-to-End Testing. One of the most common tests is the data system end-to-end test, depicted in Figure 5-1A, to check the overall performance of the system – the transmit data set, the transmission line, and the receive data set. If the system under test is half-duplex, the test may be run in one direction and then repeated in the opposite direction. If the system is full-duplex, both directions may be tested simultaneously.

5.11 Full-Duplex Back-to-back Testing. A typical arrangement for looped-back testing of a full-duplex data set is shown in Figure 5-1B. This arrangement requires only one 1914C.

5.12 Matrix Programming. The input/output leads of the test set are assigned to the horizontal buses of the matrix. The vertical buses connect to the A and B serial data interface connectors and their functions correspond to EIA RS-232-C pin assignments (see Table 2-2). Interconnection of the data and test set buses is accomplished by shorting pins, and the horizontal bus assignment is such that the program for most data sets requires placing the pins approximately along a diagonal line as shown in Figure 5-2. (Figure 5-2 is intended as an illustration only.) Using the table in conjunction with the illustration, pin 1 (AA) of the interface is connected to test set GRD, pin 2

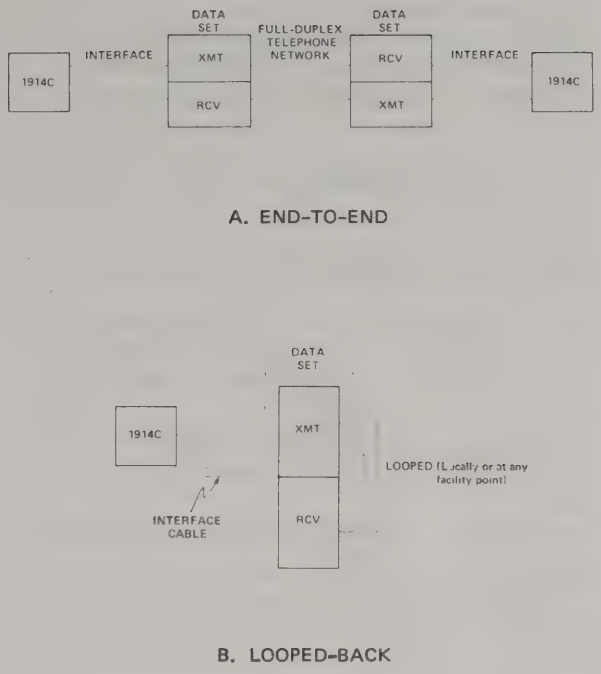


Figure 5-1. Typical Test Arrangement for Full-Duplex Operation

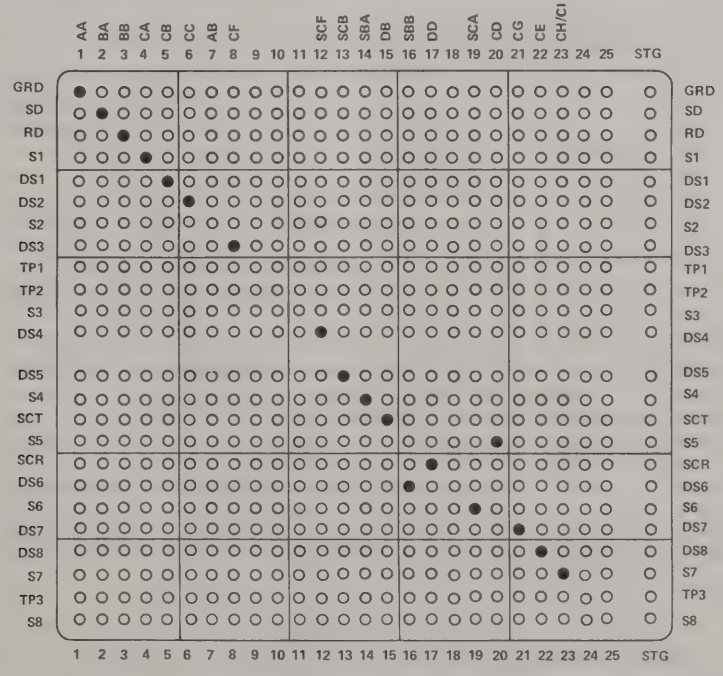


Figure 5-2. Simulated Program of 1914C Test Set Matrix

(BA) is connected to the SD bus that carries the transmit word generator output. Similarly, pin 3 (BB) is connected to the RD bus that accepts the received data input. The transmit and receive clock signals from the data set appear on horizontal buses SCT and SCR. Switches S1, S5, S6, and S7 apply control signals to interface pins 4, 20, 19, and 23, respectively. Switch S4 is used to simulate a low-speed secondary transmitted data input (SBA) on interface pin 14, and lamps DS1 through DS8 are programmed to monitor the output of the data set.

NOTE: AA, BA, BB, etc, are all EIA designations. Table 2-2 also lists CCITT V.24 pin assignments for data transmission equipment that correspond to EIA RS-232-C Standards.

5.13 Preparation

Step 1
Connect the data set to the A or B connector on the test set.

Step 2
Insert pins in the program matrix for the proper interconnection of interface control leads between the data set and the test set.

Step 3
Set the INTERFACE MODE switch on VOLTAGE or CONTACT, as required. The setting usually will be VOLTAGE for serial data sets.

Step 4
Operate switches S1 through S8 to place control signals on the appropriate interface leads. Observe lamps DS1 through DS8 for the proper response.

5.14 Transmit Tests – Synchronous or Asynchronous Data Sets.

Step 1
Operate the TEST SET MODE switch to SER.

Step 2
For **synchronous** data sets, set the transmit BIT RATE switch to EXT+ or EXT–, depending on the desired phase relationship of clock signal to data signal. The setting normally will be EXT+. For **asynchronous** data sets, set the transmit BIT RATE switch to the appropriate bit rate.

Step 3
Operate the SIG LEV switch to the required position. For data sets conforming to EIA or CCITT specifications, the signal level must be ±4 volts.

Step 4
Turn the transmit WORD LENGTH switch to the desired test signal.

5.15 Receive Tests – Synchronous Data Sets.

Step 1
Turn the TEST SET MODE switch to SER.

Step 2
Set the receive WORD LENGTH switch to agree with the transmitted word.

Step 3
Operate the COUNTER switch to BIT ERRORS or BLOCK ERRORS, as required. Block errors can only be counted with the receive WORD LENGTH switch set on 63, 511, or 2047.

Step 4
Turn the receive BIT RATE switch to EXT+ or EXT–, depending on the desired phase relationship of clock signal to data signal. Normally, the position will be EXT+.

Step 5
Operate the receive WORD SYNC switch momentarily to MAN, or set the switch to AUTO.

Step 6
Press the RESET switch to clear the counter.

Step 7
Observe the recorded error count on the counter display. With the WORD SYNC switch on AUTO, the error count displayed is almost three times the true number of errors.

NOTE: If the NO DATA or NO CLOCK indicator lamp lights at any time during an error rate test, a malfunction is indicated. The malfunction must be present for several seconds to light either one of these lamps.

5.16 Receive Tests – Asynchronous Data Sets.

Step 1
Operate the TEST SET MODE switch to SER.

Step 2
Set the receive WORD LENGTH switch to agree with the transmitted word.

Step 3
Operate the COUNTER switch to BIT ERRORS or BLOCK ERRORS, as required. Block errors can only be counted when the receive WORD LENGTH switch is on 63, 511, or 2047.

Step 4
Turn the PHASE control to midposition, with the dot pointing up.

Step 5
Set the receive BIT RATE switch to agree with the transmitted bit rate.

Step 6
Operate the FUNCTION switch to PHASE ADJ.

Step 7
Adjust the PHASE control for a null (zero) on the meter.

Step 8
Operate the FUNCTION switch to some position other than PHASE ADJ. Do not return the switch to the PHASE ADJ position at any time during the remainder of the test.

Step 9
Operate the SAMPLE WIDTH switch to .5 μs.

Step 10
Operate the WORD SYNC switch momentarily to MAN, or set it on AUTO.

Step 11
Turn the SAMPLE WIDTH switch to the sampling width desired for error margin testing.

Step 12
Press the RESET switch and observe the error count on the counter display. With the WORD SYNC switch on AUTO, the error count displayed is nearly three times the true number of errors.

NOTE: If the NO DATA or NO CLOCK lamp lights at any time during an error rate test, a malfunction is indicated. The malfunction must be present for several seconds to light either one of these lamps.

TESTING PARALLEL DATA SETS

NOTE: The transmit and receive parallel data sections are designed to test WECo 402-type modems.

5.17 Preparation

Step 1
Connect the data set to the C (transmit) or D (receive) connector on the test set.

Step 2
Insert pins in the program matrix for the proper interconnection of interface control leads between the data set and the test set. See Figure 5-3.

Step 3
Set the INTERFACE MODE switch on CONTACT.

Step 4
Operate switches S1 through S8 to place control signals on the appropriate interface leads. Observe lamps DS1 through DS8 for the proper response.

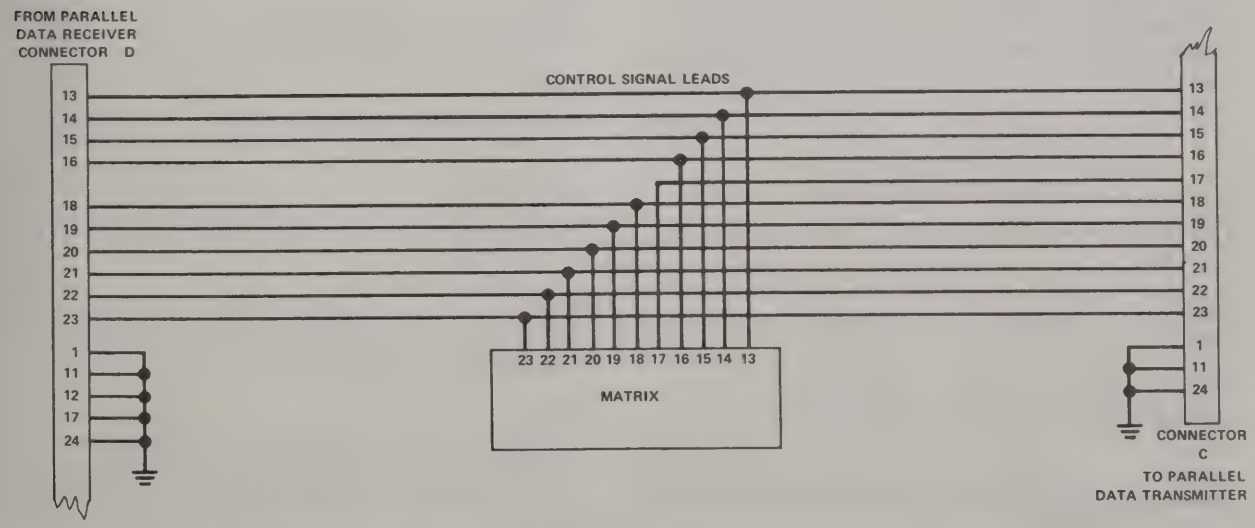


Figure 5-3. Programming for Transmit and Receive Parallel Data Set Tests

Step 5
Operate the parallel data set TEST MODE switch to ALL SPC to place a spacing condition on all channels, to ALL DOT to apply alternate mark and space signals on all channels, or to one of the eight numbered CHAN positions to place a test word on that channel at the same time that a dot signal is applied to all other channels.

5.18 Transmit Tests

Step 1
Operate the transmit WORD LENGTH switch to select the desired test signal.

Step 2
Operate the SIG LEV switch to ±4V.

Step 3
Operate the transmit BIT RATE switch to EXT+.

Step 4
Set the TEST SET MODE switch on 402.

Step 5
Operate the parallel data TEST MODE switch to ALL RDM to test all eight channels simultaneously, or operate the switch to the appropriate CHAN/1–8 position to check any channel individually.

Step 6
Operate the parallel data TRMTR CLOCK PHASE switch to RET, NOR, or ADV, as required. In an end-to-end test, the TRMTR CLOCK PHASE switch may be operated to ADV or RET on the transmitting data test set to change the phase relationship between the clock signal and the data signal by 1.5 millisecond. This establishes a marginal condition which normally will increase errors at the receiving data set.

5.19 Receive Tests

Step 1
Operate the receive WORD LENGTH switch to the desired test signal.

Step 2
Operate the receive BIT RATE switch to EXT+.

Step 3
Operate the TEST SET MODE switch to 402.

Step 4
Operate the COUNTER switch to BIT ERRORS or BLOCK ERRORS, as required.

Step 5
Operate the parallel data TEST MODE switch to ALL RDM to test all eight channels simultaneously, or operate the switch to the appropriate CHAN/1–8 position to check any channel individually.

Step 6
Operate the WORD SYNC switch momentarily to MAN, or set it on AUTO.

Step 7
Press the RESET switch to clear the counter.

Step 8
Observe the recorded error count on the counter display. With the WORD SYNC switch on AUTO, the error count displayed is almost three times the true number of errors.

NOTE: If the NO DATA or NO CLOCK lamp lights at any time during an error rate test, a malfunction is indicated. The malfunction must be present for several seconds to light either of these lamps.

TESTING ANALOG DATA SETS

5.20 Analog data sets are tested by applying precision dc voltages to the transmit (SD) lead and measuring the receive (RD) output voltage. Interface connections are established on the program matrix and the data set control functions are checked by using S1 through S8 and DS1 through DS8.

5.21 Transmit Tests

Step 1
Turn the reference voltage SELECT switch to the desired fixed voltage or to the ADJ position.

Step 2
Operate the OUTPUT switch to TP3.

Step 3
Insert a shorting pin at the intersection of the TP3 horizontal bus and the vertical bus connected to the SD lead.

Step 4
Set the VERTICAL MONITOR switch to the position corresponding to the SD interface lead.

Step 5
If the voltage is to be adjustable, operate the FUNCTION switch to VOLT INT and the RANGE switch to the appropriate DCV range. Set the meter to the desired voltage.

5.22 **Receive Tests**

Step 1
Set the VERTICAL MONITOR switch on the position corresponding to the RD interface lead.

Step 2
Operate the FUNCTION switch to VOLT INT and the RANGE switch to the appropriate DCV range.

Step 3
The receive voltage should be the same as the transmit voltage, both in magnitude and polarity, within the modem manufacturer's specified limits.

4-dB PAD

5.23 A 4-dB or 600-ohm terminating pad is connected across the meter input terminals through the 600 OHM TERM/BRIDGE switch (600 OHM TERM position) when the meter circuit is set up to read ACV (RANGE switch). The pad may be used to reduce the signal-to-noise ratio of a received signal by applying the signal to the meter input terminals as well as to the normal 1914C input.

SECTION 6
MAINTENANCE

GENERAL

6.01 This section of the manual covers maintenance that can be performed at the operator level. Operator or field level maintenance is restricted to an operational check and the replacement of defective fuses and lamps and broken lenses. For maintenance instructions beyond the scope of field level, refer to Sierra Maintenance Supplement SMS-1914C. If additional information covering servicing or maintenance of the equipment is needed, contact the Customer Service Department, Sierra Electronic Operation, Philco-Ford Corporation, 3885 Bohannon Drive, Menlo Park, California 94025.

NOTE: If defective equipment is to be returned to the factory under the terms of the Warranty, contact the Customer Service Department of Sierra Electronic Operation before packing and shipping.

OPERATIONAL CHECK

6.02 **General.** The operational test procedure ensures that the data transmission test set is operating properly. This check procedure should be made by the operator when the equipment is received, when the integrity of the unit is in doubt, and after prolonged periods of storage. Otherwise, perform the tests on a routine basis. Most of the tests can be performed without test equipment. Several, however, require the test equipment listed in Table 6-1. More detailed test and troubleshooting information is contained in SMS-1914C.

CAUTION: Before proceeding with the operational check, make sure that all test leads and matrix pins have been removed, that all interface selector switches are depressed, and that all interface and test cables are free of shorts, opens, and crosses.

Table 6-1. Required Test Equipment

DESCRIPTION	APPLICATION
Audio oscillator. Hewlett-Packard 200CD or equivalent.	Checking calibration of ac voltmeter.
Counter. Hewlett-Packard 5245L or equivalent.	Checking clock rates.
Oscilloscope with dual-trace plug-in. Tektronics 543B.	Checking phase relationship of data and clock signals.
Oscilloscope, storage type, with dual trace plug-in. Tektronics 564B or equivalent.	Close examination of data and clock signals.

6.03 **Fuses.** Use the procedure outlined below to determine whether the fuses in the 1914C are good. If a specific operation indicates that a fuse has failed, check the switch settings and any matrix connections before removing the test set from its case to check the fuses (Paragraph 6.14). If after inspection it is determined that a suspected fuse is good, refer the equipment to the corrective maintenance group responsible for trouble shooting and repair.

STEP	PROCEDURE AND PART CHECKED	NORMAL INDICATION
1	POWER switch – Operate (Fuse F1)	POWER lamp lights and test set is operative.
2	TEST SET MODE switch – SER RCV BIT RATE switch – EXT+ (Fuse F2)	Receive NO DATA and NO CLOCK lamps light.
3	Set as follows:	
	FUNCTION switch – VOLT IN RANGE switch – DCV/10 SELECT switch – +2.0 OUTPUT switch – TP3 VERTICAL MONITOR switch – 1 POLARITY switch – NOR Matrix – Shorting pin on TP3 vertical 1 (Fuse F3)	Meter reads 2.0 volts.
4	SELECT switch – -2.0 POLARITY switch – REV (Fuse F4)	Meter reads 2.0 volts
5	Shorting pin on TP3 vertical 1 – Remove	
6	Set as follows:	
	FUNCTION switch – VOLT/OHM EXT RANGE switch – X1 INPUT terminals – Short-circuit with a test lead ZERO OHMS control – Adjust meter pointer (Fuse F5)	Able to move meter pointer to 0Ω.
7	POWER switch – Operate	POWER lamp goes off.
8	INPUT terminals – Remove test connections	

6.04 Control Signals. The procedure outlined below tests the manual control switches and their associated indicator lamps by applying both a voltage signal and a contact closure to ground to each switch position. Table A following this test procedure gives the matrix connections for switches S1 through S8 and lamps DS1 through DS8. Operator maintenance permits changing a defective lamp or broken lens (Paragraph 6.15).

STEP	PROCEDURE AND PART CHECKED	NORMAL INDICATION
1	Matrix – Insert shorting pins as shown in Table A and Figure 6-1. Switch S1 through S8 – OFF	
2	POWER switch – Operate	POWER lamp lights.
3	INTERFACE MODE switch – CONTACT	Lamps DS1 through DS8 are off.
4	Switch S1 through S8 – ON (Lamps DS1 through DS8)	Lamps DS1 through DS8 light. (See Note)
5	Switch S1 through S8 – OFF	Lamps DS1 through DS8 go off.
6	INTERFACE MODE switch – VOLTAGE	Lamps DS1 through DS8 remain off.
7	Repeat Steps 4 and 5	
8	Set as follows: FUNCTION switch – VOLT INT RANGE switch – DCV/10 VERTICAL MONITOR switch – 1 through 8 in turn Switch S1 through S8 – ON and OFF, in turn, with switches operated corresponding to VERTICAL MONITOR switch positions	Meter indication of +4.0 volts ±0.3 volt for S1 through S8 ON position, and -4.0 volts ±0.3 volt for OFF position.
9	POWER switch – Operate	POWER lamp goes off.
10	MATRIX – Remove shorting pins	

NOTE: If an indicator lamp fails to light with the INTERFACE MODE switch on CONTACT, test the position with a voltmeter. Set the FUNCTION switch to DCV/30 and set the VERTICAL MONITOR switch to the required position. The meter will indicate 0 for a lamp failure. If the meter indicates +23 volts dc, the trouble is in the 1914C.

Table A. Matrix Connections and Switch Settings for Testing Control Signal Lamps

MATRIX CONNECTIONS		TOGGLE-SWITCH SETTINGS		NORMAL INDICATIONS	
HORIZONTAL ROW	VERTICAL COLUMN	SWITCH	POSITION	LAMP	CONDITION
DS1 S1	1 1	S1	ON OFF	DS1	Lighted Off
DS2 S2	2 2	S2	ON OFF	DS2	Lighted Off
DS3 S3	3 3	S3	ON OFF	DS3	Lighted Off
DS4 S4	4 4	S4	ON OFF	DS4	Lighted Off
DS5 S5	5 5	S5	ON OFF	DS5	LIghted Off
DS6 S6	6 6	S6	ON OFF	DS6	Lighted Off
DS7 S7	7 7	S7	ON OFF	DS7	Lighted Off
DS8 S8	8 8	S8	ON OFF	DS8	Lighted Off

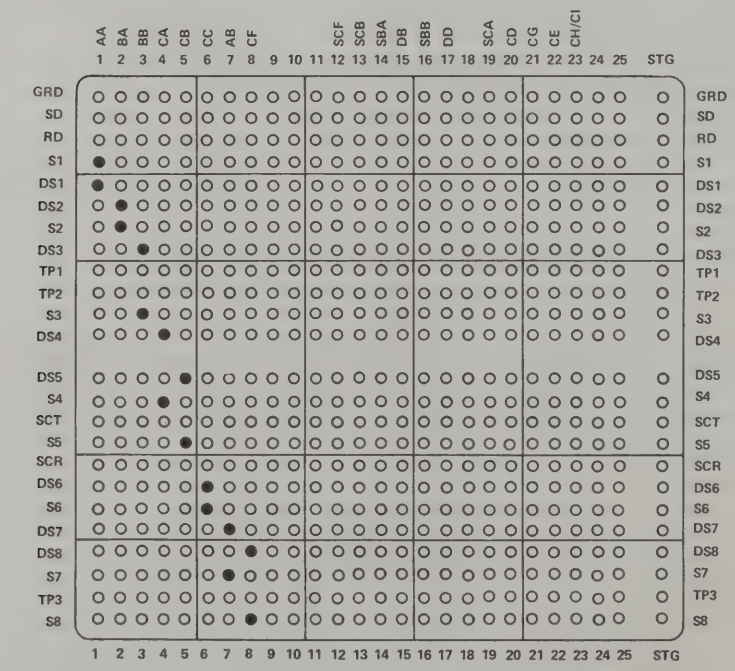


Figure 6-1. Matrix Programmed for Control Signal Clock

6.05 Interval Counter. The following procedure tests the ability of the interval counter to detect the first occurrence of a preselected signal transition. The procedure also provides a test of the counter display.

STEP	PROCEDURE AND PART CHECKED	NORMAL INDICATION
1	Switches S1 through S8 – OFF	
2	Matrix – Shorting pins as follows: TP1, vertical 1 S1, vertical 1 TP2, vertical 2 S2, vertical 2	
3	FUNCTION switch – OFF	
4	POWER switch – Operate	POWER lamp lights.
5	INTERFACE MODE switch – CONTACT	
6	BIT RATE switch – 2400	
7	TEST SET MODE switch – INTERVAL START switch – A or B	
8	TP1 TRIGGER switch TP2 TRIGGER switch – -/CLOSE	
9	COUNTER switch – INTERVAL/X100	
10	RESET switch – Operate	Counter display reads 00.
Use a suitable timer (see Table 6-1)		
11	Switch S1 – ON (TP1 FIRST lamp)	Counter display starts. TP1 FIRST lamp lights.
12	After 5 seconds: Switch S2 – ON	Counter display stops at approximately 50. TP1 FIRST lamp remains lighted.
13	TP1 TRIGGER switch TP2 TRIGGER switch – +/OPEN	
14	RESET switch – Operate	Counter display reads 00.
Use the timer.		
15	Switch S2 – OFF	Counter display starts. TP1 FIRST lamp does not light.
16	After 5 seconds: Switch S1 – OFF	Counter display stops at approximately 50.
17	POWER switch – Operate	POWER lamp goes off.
18	Matrix – Remove shorting pins	

6.06 **Word Generator and Clock.** The following procedure tests the ability of the word generator to produce its four test messages – a dot signal, a 63-bit test message, a 511-bit test message, and a 2047-bit test message. It also tests the ability of the clock to generate a signal over the range of 150 to 2400 bits per second.

STEP	PROCEDURE	NORMAL INDICATION
1	TP1 – Connect lead from black INPUT connector TP2 – Connect lead from red INPUT connector	
2	Set as follows: METER POLARITY switch – REV TEST SET MODE switch – SER COUNTER switch – BIT ERRORS FUNCTION switch – OFF Both BIT RATE switches – 1600 SIGNAL LEVEL switch – ± .7V Both WORD LENGTH switches – 63	
3	Matrix – Shorting pins as follows: GRD, vertical 1 SD, vertical 2 TP1, vertical 1 TP2, vertical 2	
4	POWER switch – Operate	POWER lamp is lighted.
5	RANGE switch – 1VAC	
6	FUNCTION switch – VOLT/OHM EXT	TRANSMIT NO DATA lamp is off. RCV NO DATA lamp is on. Meter indicates 0.60 volt ac ±0.05 volt.
7	TRANSMIT WORD LENGTH switch – 511	Meter indicates 0.60 volt ac ±0.05 volt.
8	TRANSMIT WORD LENGTH switch – 2047	Meter indicates 0.60 volt ac ±0.05 volt.
9	TRANSMIT WORD LENGTH switch – DOT	Meter indicates 0.75 volt ac ±0.075 volt.
10	Set as follows: FUNCTION switch – OFF RCV BIT RATE switch – 150 RCV WORD LENGTH switch – 63	
11	TEST SET MODE switch – SER	Counter display indicator counting. RCV NO DATA lamp is on.
12	RESET switch – Operate and hold	Counter display reads 00. OVERFLOW lamp remains off.

6.06 Word Generator and Clock (Cont)

STEP	PROCEDURE	NORMAL INDICATION
13	RESET switch – Release	Counter display resumes counting. OVERFLOW lamp lights when count goes from 99 to 00.
14	RCV BIT RATE switch – Operate through all positions (150 through 2400)	Counter display rate increases for each step increase of BIT RATE switch.
15	Both BIT RATE switches – EXT+	Counter display stops. RCV NO CLOCK lamp lights after brief pause.
16	Both BIT RATE switches – EXT-	Counter display remains stopped. RCV NO CLOCK lamp remains on. RCV NO DATA lamp may go out momentarily.
17	FUNCTION switch – VOLT/OHM EXT	RCV NO CLOCK and NO DATA switches remain lighted. May go out momentarily.
18	RANGE switch – DCV/1	Meter indicates 0.7 volt dc ±0.1 volt. NOTE: If meter reads downscale, set POLARITY switch to opposite position.
19	TRANSMIT BIT RATE switch – Operate between EXT+ and EXT- until proper meter reading is obtained.	Meter reads downscale.
20	POLARITY switch – Operate to opposite position.	Meter indicates 0.7 volt dc ±0.15 volt.
21	RANGE switch – DCV/10	
22	SIG LEV switch – ±4V	Meter indicates 4.0 volts dc ±0.5 volt.
23	TRANSMIT BIT RATE switch – Operate between EXT+ and EXT- until proper meter reading is obtained	Meter reads downscale.
24	POLARITY switch – Operate to opposite position	Meter indicates 4.0 volts dc ±0.5 volt.
25	Set as follows: FUNCTION switch – OFF SIG LEV switch – ± .7V TRANSMIT BIT RATE switch – 1600 RANGE switch – ACV/1	
26	FUNCTION switch – SPKR	Raspy noise in speaker.

6.06 **Word Generator and Clock (Cont)**

STEP	PROCEDURE	NORMAL INDICATION
27	VOLUME control – Rotate in a clockwise direction	Speaker level increases as control is rotated clockwise.
28	POWER switch – OFF	POWER lamp goes off.
29	Remove test connections.	

6.07 **Parallel Data Circuits.** The following procedure tests the ability of the 1914C to generate the type of signals required for parallel data sets.

STEP	PROCEDURE	NORMAL INDICATION
1	TP1 – Connect lead from black INPUT connector TP2 – Connect lead from red INPUT connector	
2	Interface cable between: Connector A and Connector D Connector B and Connector C	
3	Set as follows: TERM/BRIDGE switch – TERM TEST MODE switch – ALL DOT TEST SET MODE switch – 402 Both BIT RATE switches – EXT+ SIG LEV switch – ±4V FUNCTION switch – OFF RANGE switch – ACV/1 Both WORD LENGTH switches – DOT COUNTER switch – BIT ERRORS	
4	Matrix – Shorting pins as follows: GRD, vertical 25 TP2, vertical 25	
5	POWER switch – Operate	POWER lamp lights.
6	FUNCTION switch – VOLT/OHM EXT	

6.07 Parallel Data Circuits (Cont)

STEP	PROCEDURE	NORMAL INDICATION
7	Matrix -- Shorting pin in TP1, vertical 2	Meter indicates 0.7 to 1.1 volt ac.
8	Matrix – Remove shorting pin from TP1 vertical 2 and insert pin successively in verticals 3, 4, 5, 7, 8, 9, and 10	Meter indicates 0.7 to 1.1 volt ac in each position.
9	Matrix – Remove shorting pin from TP1 vertical 10 and insert it in TP1 vertical 6	Meter indicates 0.5 to 0.75 volt ac.
10	TRANSMIT WORD LENGTH switch – 63	
11	TEST MODE switch – ALL RDM	
12	Matrix – Remove shorting pin from TP1 vertical 6	
13	Repeat steps 7 and 8	Meter indicates 0.4 to 0.9 volt ac in each position. The meter pointer jitter is a result of random test messages.
14	TEST MODE switch – CHAN/1	
15	Matrix – Remove shorting pin from TP1 vertical 10 and insert it in TP1 vertical 2	Meter indicates 0.35 to 0.7 volt ac. The meter pointer will jitter.
16	TEST MODE switch – CHAN/2	
17	Matrix – Move the shorting pin from TP1 vertical 2 to TP1 vertical 3	Meter indicates 0.35 to 0.7 volt ac. The meter pointer will jitter.
18	TEST MODE switch – CHAN/3	
19	Matrix – Move the shorting pin from TP1 vertical 3 to TP1 vertical 4	Meter indicates 0.35 to 0.7 volt ac. The meter pointer will jitter.
20	TEST MODE switch – CHAN/4	
21	Matrix – Move the shorting pin from TP1 vertical 4 to TP1 vertical 5	Meter indicates 0.35 to 0.7 volt ac. The meter pointer will jitter.
22	TEST MODE switch – CHAN/5	
23	Matrix – Move the shorting pin from TP1 vertical 5 to TP1 vertical 7	Meter indicates 0.35 to 0.7 volt ac. The meter pointer will jitter.
24	TEST MODE switch – CHAN/6	
25	Matrix – Move the shorting pin from TP1 vertical 7 to TP1 vertical 8	Meter indicates 0.35 to 0.7 volt ac. The meter pointer will jitter.
26	TEST MODE switch – CHAN/7	

6.07 **Parallel Data Circuits (Cont)**

STEP	PROCEDURE	NORMAL INDICATION
27	Matrix – Move the shorting pin from TP1 vertical 8 to TP1 vertical 9	Meter indicates 0.35 to 0.7 volt ac. The meter pointer will jitter.
28	TEST MODE switch – CHAN/8	
29	Matrix – Move the shorting pin from TP1 vertical 9 to TP1 vertical 10	Meter indicates 0.35 to 0.7 volts ac. The meter pointer will jitter.
30	POWER switch – Operate	POWER lamp goes off.
31	Remove all test connections	

6.08 **Reference Voltages.** The following procedure checks the seven fixed voltages and the adjustable voltages from the reference voltage supply. Switch settings for the fixed voltage check and normal meter indications are given in Table B following this procedure.

STEP	PROCEDURE	NORMAL INDICATION
1	Matrix – Insert a shorting pin in TP3 vertical 1	
2	OUTPUT switch – OFF	
3	POWER switch – Operate	POWER lamp lights.
4	FUNCTION switch – VOLT INT	
5	RANGE switch – DCV/10	
6	POLARITY switch – NOR	
7	VERTICAL MONITOR switch – 1	
8	Coarse (outer) and fine (inner) ADJUST controls – Fully counterclockwise	
9	SELECT switch – +ADJ	
10	OUTPUT switch – TP3	Meter indicates 0 volt dc.
11	Both ADJUST controls – Fully clockwise	Meter pointer moves smoothly. Meter indicates +10.3 volts dc ±0.8 volt.
12	Fine ADJUST control – Fully counterclockwise	Meter indicates at least 0.5 volt dc less than reading in Step 11.
13	POLARITY switch – REV	

6.08 **Reference Voltages (Cont)**

STEP	PROCEDURE	NORMAL INDICATION
14	Both ADJUST controls – Fully counterclockwise	
15	SELECT switch – -ADJ	Meter indicates 0 volt dc.
16	Both ADJUST controls – Fully clockwise	Meter pointer moves smoothly. Meter indicates -10.3 volts dc ±0.8 volt.
17	Fine ADJUST control – Fully counterclockwise	Meter indicates at least 0.5 volt dc less than reading in Step 16.
18	SELECT switch POLARITY switch – Settings as given in Table B RANGE switch	Meter indications as given in Table B.
19	POWER switch – Operate	POWER lamp goes off.
20	Remove test connections	

Table B. Switch Settings for Testing Fixed Reference Voltages

RANGE SWITCH SETTING	POLARITY SWITCH SETTING	SELECT SWITCH SETTING	NORMAL METER INDICATION
DCV/3	REV	-2.0	1.90 to 2.10
DCV/1	REV	-1.0	0.95 to 1.05
DCV/1	REV	-.477	0.45 to 0.50
DCV/1	———	0	0
DCV/1	NOR	+.477	0.45 to 0.50
DCV/1	NOR	+1.0	0.95 to 1.05
DCV/3	NOR	+2.0	1.90 to 2.10
DCV/10	NOR	+7.0	6.65 to 7.35

6.09 **Clock Circuits.** The procedure outlined below is used to check the clock rates of the 1914C test set. An appropriate electronic counter is recommended in Table 6-1, Required Test Equipment. Switch settings for 1914C bit rate and counter tests are given in Tables C and D following this procedure.

STEP	PROCEDURE	NORMAL INDICATION
1	TRMT CLK jack GRD jack — Connect test leads to an appropriate electronic counter	
	Use a suitable electronic counter (see Table 6-1)	
2	TEST SET MODE switch – SER COUNTER switch – BIT ERRORS	
3	POWER switch – Operate Counter power switch – Operate	POWER lamp is lighted. Electronic counter is turned on.
	Allow counter to warm up for 5 minutes before proceeding	
4	TRANSMIT BIT RATE switch – Positions 150 through 2400 as shown in Table C	Counter readings within the tolerances given in Table C.
5	RCV CLK jack – Connect to counter	
6	TEST SET MODE switch – INTERVAL	
7	COUNTER switch – INTERVAL positions X.1 through X100 as shown in Table D	Counter readings within the tolerances given in Table D.
8	TRMT CLK jack – Connect to counter	
9	TRANSMIT BIT RATE switch – EXT+	
10	COUNTER switch – BIT ERRORS	
11	TEST SET MODE switch – 402	Counter should read 75 ±4 Hz.
12	POWER switch – Operate Counter power switch – Operate	POWER lamp goes off. Counter is turned off. off.
13	Remove test connections	

Table C. Switch Settings for Bit Rate Test

BIT RATE SWITCH POSITION	ELECTRONIC COUNTER FREQUENCY (Hz)
150	150±5
300	300±9
600	600±18
1,000	1,000±30
1,200	1,200±36
1,400	1,400±42
1,600	1,600±48
1,800	1,800±54
2,000	2,000±60
2,400	2,400±72

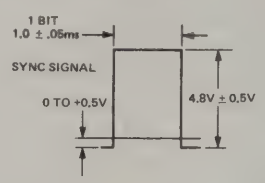
Table D. Switch Settings for Counter Test

COUNTER INTERVAL SWITCH POSITION	ELECTRONIC COUNTER FREQUENCY (Hz)
X .1	10,000±250
X 1	1,000±30
X 10	100±3.0
X 100	10±0.5

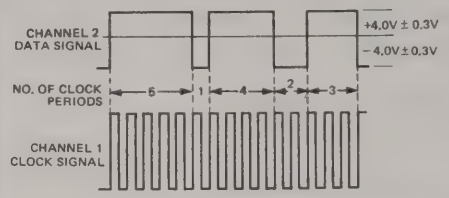
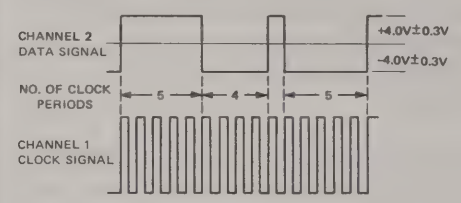
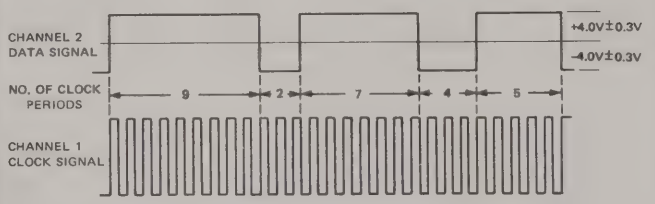
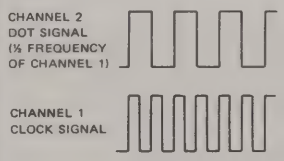
6.10 Data and Sample Circuits. In the following procedure, data synchronization and clock outputs are checked with a dual trace oscilloscope. The dual traces permit checking the phase relationship of data and clock signals. The oscilloscope must have a variable time base and must be capable of being externally synchronized. If close examination of the output is required, a storage scope is recommended. Suitable instruments are listed in Table 6-1, Required Test Equipment.

STEP	PROCEDURE	NORMAL INDICATION
1	Matrix – Shorting pins as follows: SD, vertical 1 RD, vertical 2	
2	TRANSMIT CLOCK jack – Connect to channel 1 input of oscilloscope SYNC jack – Connect to both sync terminal and channel 2 input of oscilloscope GRD terminal – Connect to ground terminal of oscilloscope	
3	Set as follows: TEST SET MODE switch – SER COUNTER switch – BIT ERRORS Both BIT RATE switches – 1000 SIG LEV switch – ±4V Both WORD LENGTH switches – 63 SAMPLE WIDTH switch – 5μs	
4	1914C POWER switch – Operate	POWER lamp lights.

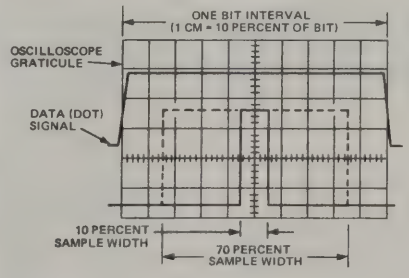
6.10 Data and Sample Circuits (Cont)

STEP	PROCEDURE	NORMAL INDICATION
5	Oscilloscope power switch – Operate	Oscilloscope turns on.
6	Oscilloscope – Set controls to observe channel 2 input, using external sync	Channel 2 waveform: 
7	Oscilloscope – Set controls to observe channel 1 input, using external sync	Channel 1 waveform: 
8	Both WORD LENGTH switches – 511	
9	Oscilloscope – Set controls to observe channel 1 input and then channel 2 input	Waveform observed in Step 6 does not change but appears at a slower rate. Waveform observed in step 7 does not change.
10	Both WORD LENGTH switches – 2047	
11	Oscilloscope – Set controls to observe channel 2 input and then channel 1 input	Waveform observed in step 7 does not change. Waveform observed in step 6 does not change but appears at a still slower rate.
12	SYNC jack – Remove lead to oscilloscope channel 2 input	
13	TRMT DATA jack – Connect lead to oscilloscope channel 2 input	
14	Set as follows: SYNC switch – AUTO Both WORD LENGTH switches – 63	

6.10 Data and Sample Circuits (Cont)

STEP	PROCEDURE	NORMAL INDICATION
15	Oscilloscope – Set controls to observe channels 1 and 2 inputs simultaneously, using external sinc	Combined channels 1 and 2 waveform: 
16	Both WORD LENGTH switches – 511 Use external sync	Combined channels 1 and 2 waveform: 
17	Both WORD LENGTH switches – 2047 Use external sync	Combined channels 1 and 2 waveform: 
18	Both WORD LENGTH switches – DOT Use external sync with oscilloscope lead connected to TRMT CLOCK jack	Channels 1 and 2 waveform: 
19	TRANSMIT CLOCK jack – Disconnect oscilloscope channel 1 lead POWER switch – Operate 1914C test set – Remove from case	 POWER lamp goes out.

6.10 Data and Sample Circuits (Cont)

STEP	PROCEDURE	NORMAL INDICATION
19 (Cont)	POWER switch – Operate	POWER lamp lights.
	TP1 of circuit pack CP2 – Connect oscilloscope channel 1 lead	
	TRMT CLOCK jack – Connect oscilloscope sync lead	
	Both WORD LENGTH switches – DOTS	
20	Oscilloscope – Using external sync, set controls to adjust time base so th that one bit interval of the data signal occupies a 10-cm sweep on the graticule	On channel 1, observe a very narrow positive pulse at center of display.
21	SAMPLE WIDTH switch – Operate to each position, 10% through 70%	The pulse width of the channel 1 input is within ±4 percent of the value of each switch position. Each pulse is centered within 2 percent of the vertical axis. 
22	POWER switch – Operate	POWER lamp goes off.
	Oscilloscope power switch	Oscilloscope is turned off.
23	Remove test connections	
	Return the test set to its case	

6.11 Word Generator, Clock and Synchronous Circuits in Loop-Back Arrangement. The following procedure checks the word generator, clock and synchronous circuits with a single 1914C looped back to receive and test its own transmit signals.

STEP	PROCEDURE	NORMAL INDICATION
1	Set as follows: TEST SET MODE switch – SER COUNTER switch – BIT ERRORS Both BIT RATE switches – 150 SIGNAL LEVEL switch – ±4V Both TRANSMIT WORD LENGTH switches – 63 SAMPLE WIDTH switch – .5μs WORD SYNC switch – OFF PHASE switch – PHASE ADJ	
2	Matrix – Shorting pins as follows: GRD, vertical 1 SD, vertical 2 RD, vertical 2	
3	POWER switch – Operate	POWER lamp lights. Meter pointer deflects. RCV NO CLOCK and NO DATA lamps go off. Counter display starts.
4	PHASE control – Adjust	Meter pointer nulls to zero.
5	FUNCTION switch – OFF	
6	WORD SYNC switch – Depress to MAN	Counter display stops.
7	TRANSMIT WORD LENGTH switch – 511, then return to 63	Counter display starts.
8	WORD SYNC switch – AUTO	Counter display stops.
9	RESET switch – Operate	Display shows 00, OVERFLOW lamp is off.
10	Both WORD LENGTH switches – 511	Counter display may run momentarily, then stop.
11	Both WORD LENGTH switches – 2047	Counter display may run momentarily, then stop.
12	Both BIT RATE switches – 300	
13	FUNCTION switch – PHASE ADJ	
14	PHASE control – Set for zero indication	Meter pointer indicates zero.

6.11 Word Generator, Clock, and Synchronous Circuits in Loop-Back Arrangement (Cont)

STEP	PROCEDURE	NORMAL INDICATION
15	FUNCTION switch – OFF	Counter display may run momentarily, then stop.
16	Both BIT RATE switches – Repeat Steps 13 through 15 for positions 600 through 2400	Meter and counter display the same as Steps 14 and 15.
17	WORD SYNC switch – OFF	
18	TRANSMIT WORD LENGTH switch – 63	
19	COUNTER switch – BLOCK ERRORS/WL	Counter display runs at a slower rate.
20	COUNTER switch – Set to each BLOCK ERRORS position, 2WL through 16WL	Counter display runs slower for each increase in block length.
21	POWER switch – Operate	POWER lamp goes off.
22	Remove all test connections	

6.12 Parallel Data Circuits in Loop-Back Arrangement. The following procedure checks parallel data circuits with a single 1914C looped back to receive and test its own transmit signals.

STEP	PROCEDURE	NORMAL INDICATION
1	Interface cable – Connect between Connector C and Connector D	
2	Set as follows: TEST MODE switch – ALL RDM TRANSMIT WORD LENGTH switch – 63 TRMTR CLOCK PHASE switch – ADV SIG LEV switch – ±4V TEST SET MODE switch – 402 COUNTER switch – BIT ERRORS TRANSMIT BIT RATE switch – EXT+ RCV BIT RATE switch – EXT- WORD SYNC switch – OFF	
3	POWER switch – Operate	POWER lamp lights. Counter display runs.
4	WORD SYNC switch – MAN	Counter display stops.
5	TEST MODE switch – CHAN 1 TRANSMIT WORD LENGTH switch – 511 and back to 63	Counter display runs.
6	WORD SYNC switch – MAN	Counter display stops.

6.12 **Parallel Data Circuits in Loop-Back Arrangement (Cont)**

STEP	PROCEDURE	NORMAL INDICATION
7	TEST MODE switch – Repeat Steps 5 and 6 in CHAN 2 through CHAN 8 positions	
8	TRMTR CLOCK PHASE switch – Repeat Steps 5 through 7 in NOR position	
9	POWER switch – OFF	POWER lamp goes off.
10	Remove all test connections	

6.13 **Check of AC Voltmeter.** The ac meter circuit in the 1914C has a 600-ohm input impedance. An external reference signal, preferably at a level of 0 dBm and known to be accurate within 0.1 dB, is required for an ac voltage check and for possible calibration by repair facility personnel. Appropriate signal generators (audio oscillators) are listed in Table 6-1, Required Test Equipment.

Step 1
Operate the TERM/BRIDGE switch to 600 OHM TERM.

Step 2
Connect the output of the signal generator to the INPUT terminals of the 1914C test set.

Step 3
Turn the signal generator on and set its output to some value within the ac voltage range of the 1914C meter.

Step 4
Operate the POWER switch to turn the 1914C on.

Step 5
Turn the FUNCTION switch to VOLT/OHM EXT.

Step 6
Operate the RANGE switch to the ACV position that will come closest to producing a full-scale deflection of the test set meter. The meter reading should be the same as the known input voltage.

NOTE; If the 1914C meter reading is not the same as the input voltage, refer the test set to shop maintenance facilities for calibration of the ac voltmeter.

Step 7
Operate the POWER switch to turn the test set off. Turn the signal generator off and remove all test connections.

REPLACING FUSES

6.14 The fuse panel is located at the left rear of the chassis (Figure 6-2). The five fuses are mounted in twistlock fuse holders. Spare fuses are mounted in spring clips on a separate board. Both the fuse panel and spare fuse mounting board are marked as to fuse type and value. To gain access to the fuses for checking and replacement, proceed as follows:

Step 1
Disconnect the power cord from the ac supply. Stand the unit on the four rubber feet on the front of the case and loosen the four quick-release fasteners on the bottom of the case.

Step 2
With the front panel facing up, lift the 1914C chassis out of the case, using the bails on either side of the front panel.

Step 3
To inspect or replace a fuse, turn the twistlock fuse holder counterclockwise and withdraw the fuse.

Step 4
Place a new fuse in the fuse holder. Push the fuse holder in its socket, turning it clockwise to lock the fuse in place.

WARNING: Do not use fuses other than the types specified. The equipment may be seriously damaged by improper substitutes.

REPLACING POWER SWITCH LAMP

6.15 The power switch lamp is located inside the button which also serves as the lens. To replace the lamp, proceed as follows:

Step 1
Unscrew and remove the knurled metal retaining ring.

Step 2
Pull out the lens/pushbutton and extract the lamp.

Step 3
Replace the lamp. Position the lens/pushbutton and screw the retaining ring in place.

REPLACING INDICATOR LAMPS

6.15 All of the indicator lamps are covered by threaded plastic caps with knurled outer rims. To replace an indicator lamp, proceed as follows:

Step 1
Unscrew and remove the plastic cap and pull the lamp from its socket.

Step 2
Press the new lamp in place, being careful not to bend the contacts.

Step 3
Screw the lens in place.

6.16 Table 6-2 lists the field replaceable parts.

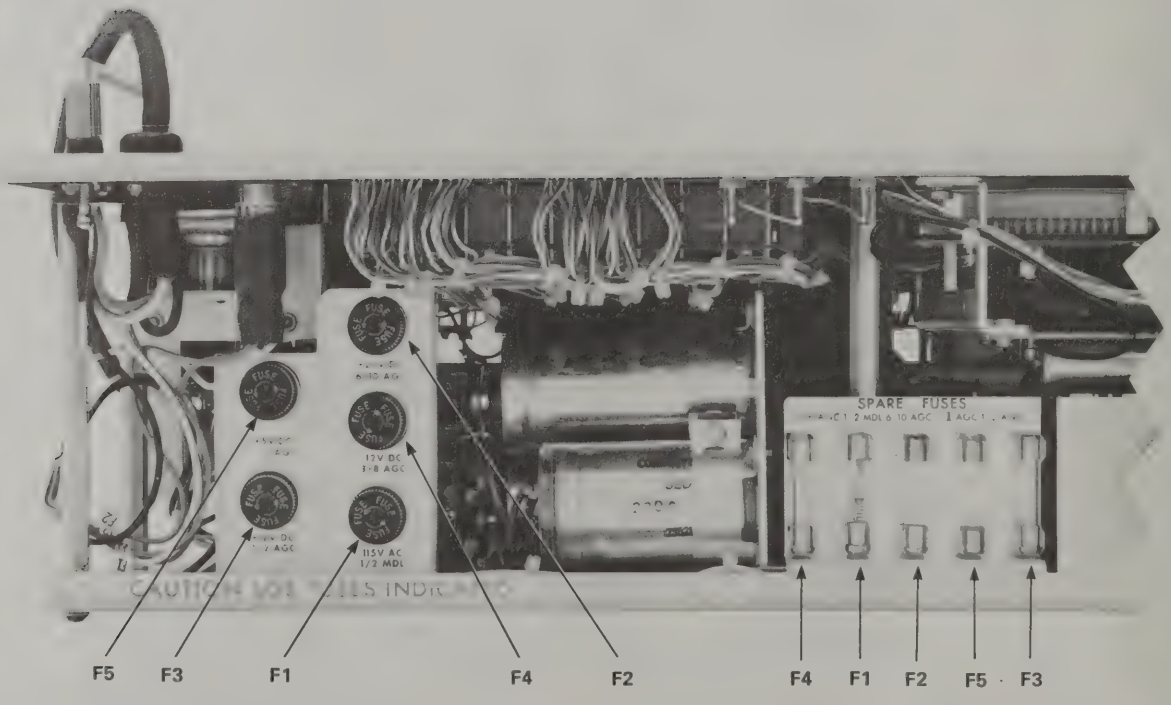


Figure 6-2. Back of Chassis Showing Fuse Panel and Spare Fuse Board

Table 6-2. Field Replaceable Parts

PART	MANUFACTURER	SIERRA STOCK NO.	MANUFACTURER'S STOCK NO.
Fuse F1, 1/2 amp Slow-blow	Bussman	913200042	MDV-1/2A
Fuse F2, 0.6 amp	Bussman	913200043	AGC
Fuse F3, 1/2 amp	Bussman	913200044	AGC
Fuse F4, 3/8 amp	Bussman	913200046	AGC
Fuse F5, 1 amp, 3 AG type	Littelfuse	913200048	312001
Lamp, control circuit/indicator	Sylvania	913800046	30934
Lamp, power switch	Chicago Miniature	913800058	AIG
Lens, control circuit, white	Sylvania	913800047	30146
Lens, indicator, amber	Sylvania	913800050	30140
Lens, indicator, blue	Sylvania	913800048	30143
Lens, indicator, red	Sylvania	913800049	30142
Pin, programming, 10 ohms, gray	Sealectro	919900047	
Pin, programming, 18 ohms, green	Sealectro	919900048	
Pin, programming, 10K ohms, black	Sealectro	919900069	
Pin, shorting	Sealectro	919900046	0772-002-27-2

SIERRA ELECTRONIC OPERATION

Marketing Department

PRODUCT RETURN REPORT

Authorization For Return

(Please Print or Type)

1. Customer _____
   Address _____
   _____
   _____

2. Item Returned. _____
   Model No. _____
   Serial No. _____

3. Return Authorized By _____
   (Sierra Representative)

4. Area Code and Telephone No. and Party to Contact
   for Further Details _____
   _____

5. Reason for Return
   (Please Explain in Full Detail the Indications of Failure)
   _____
   _____
   _____
   _____
   _____
   _____
   _____
   _____
   _____
   _____
   _____
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Warranty

SIERRA ELECTRONIC OPERATION, PHILCO-FORD CORPORATION warrants products manufactured by it to be free from defects in material and workmanship and to meet the applicable specifications under normal use and service for a period of 12 months from the date of original shipment by us. Our obligation under this warranty is limited to the repair or replacement of such products which, after having been returned to the factory or a point designated by us, shall be examined and in our sole opinion, found defective and that such defect was not induced by causes external to the product. Alternately, SIERRA may elect to issue credit for any such defective product.

All products to be repaired or replaced shall be returned prepaid to the designated place of repair in accordance with authorization and packing and shipping instructions issued by SIERRA. Return shall not be made until such authorization and instructions are issued. Each returned product shall be accompanied by a statement or report fully stating the claimed defects and any other pertinent information concerning the failure.

SIERRA'S responsibility under this warranty does not apply to any products which have been repaired, worked upon or altered by persons not authorized by us so as to in our sole judgement, injure the stability or reliability of such product, or which have been subject to misuse, negligence or accident, or where applicable, the serial number has been altered, effaced or removed. SIERRA shall not be liable for damages resulting from the use of the purchased product, nor shall SIERRA be responsible for any failure in the performance of other items to which the purchased product is connected or the functioning of an entire system or parts of any system of which the purchased product may be a part.

SIERRA reserves the right to make changes in the design or construction of any of its products at any time without incurring any obligation to make changes whatever on units previously purchased. Accessories, including but not limited to all vacuum tubes, fuses, pilot lamps and batteries used with our products are not covered by this warranty. A test setup charge of $25.00 will apply to any returned instrument or microwave component which, after test, is found to meet the applicable specifications.

This warranty is in lieu of all other warranties, expressed, implied or statutory. No representative or person is authorized to represent nor assume for SIERRA any liability in connection with the sale of products other than set forth herein. IN NO EVENT SHALL SIERRA BE LIABLE FOR SPECIAL INCIDENTAL OR CONSEQUENTIAL DAMAGES.